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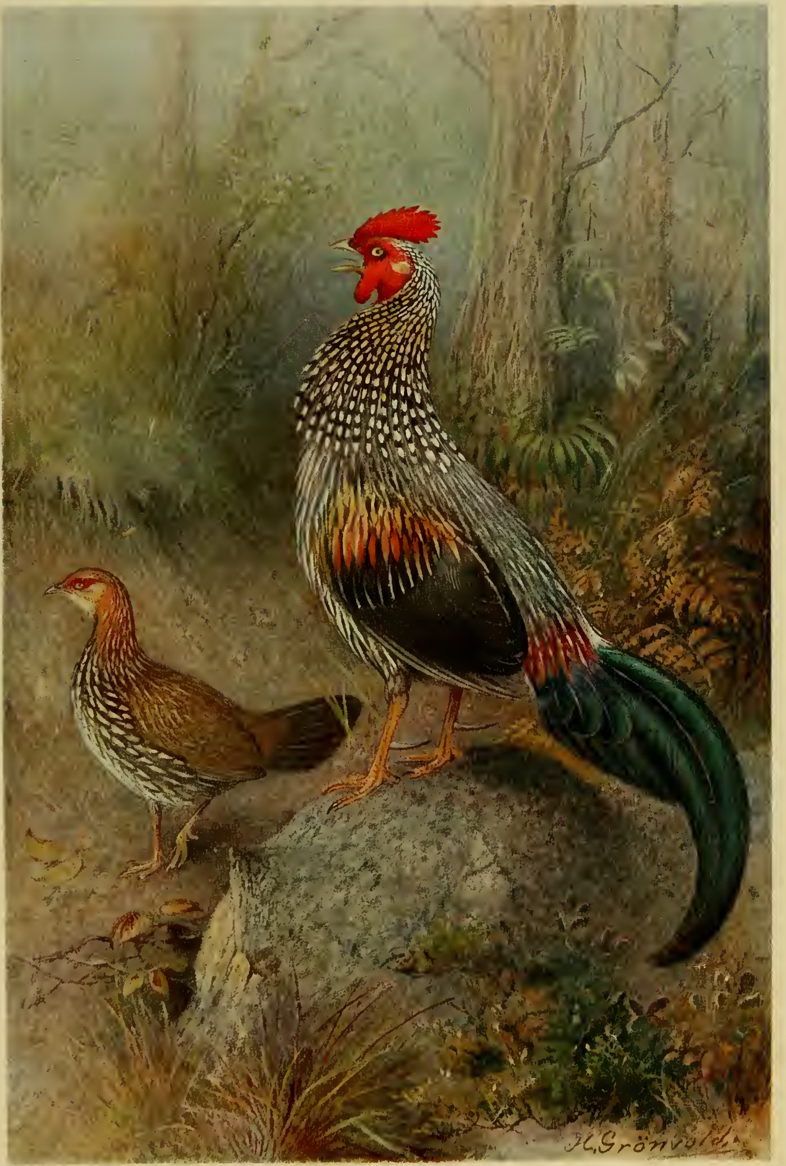

MENPES PRESS, WATFORD

GALLUS SONNERATI.

The Grey Jungle-fowl.

$\frac{1}{5}$ Natural Size.

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ERRATA.

No. 1, Volume XXIV.

Page 186, in column " length " line 8, *for* 7′ 11″ *read* 7′ 1″.
,, ,, in column " Remarks" *for* " 511 lbs." *read* " 565 lbs."

No. 1, Volume XXV.

Page 80, line 22, *for Engenii read Eugenii.*

No. 2, Volume XXV.

Page 233, line 18, *for* " Type C " *substitute* Type B.
,, 236 ,, in the middle of the page under Type " B " should be " C " and " C " should be " B "
,, 237, lines 21 and 22, under Type, substitute " C " for " B " and " B " for " C. "

No. 3, Volume XXV.

Page 475, line 25, *for* " a fine onmusth (tuskless male) " *read* " a Hine (= tuskless male) on musth. "
,, 493 ,, 18, *for* " Home-like " *read* " Hun-like."
,, 494 ,, 8, from the bottom, *for* " big level " *read* " High-level. "
,, 508 ,, 14, delete " them. "
,, 508 ,, 6, from the bottom, *for* " dupped " *read* " dropped. "
,, 513 ,, 14, from top, *for* negative *read* vegetative.
,, 513 ,, 20, from top, *for* 1914 *read* 1917.

No. 4, Volume XXV.

Page 669, 5 lines from bottom of page, *for Certhia himalayan read Certhia himalayana.*
,, 767, line 19, *for Eublepharius read Eublepharis.*

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JOURNAL
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Mar. 1917. Vol. XXV. No. 1.

NOTICE.

No. 5—THE INDEX NUMBER—OF VOL. XXIV

has been delayed owing to the manuscript of the Index not having arrived from England. It will be published and issued to members as soon as possible and will also include a General Index of Volumes XVIII to XXIV, inclusive. The previous General Indexes were published as follows :—

Vols. I to XIII, in No. 5, Vol. XIII.

Vols. XIV to XVII, in No. 5, XVII.

EDITORS.

Journal, Bombay Natural History Society.

March 1917.

The males are all furnished with a fleshy crest or comb and with wattles or lappets either hanging from each side of the throat, as in all three of the Indian species, or with a single one from the centre of the throat as in the Sunda Island bird, *varius*. The tail consists of fourteen feathers in our three species and of sixteen in the last mentioned bird. The wings are well rounded, the first primary being shorter than the tenth and the fifth the longest. The central tail feathers in the male are greatly lengthened, being from three to four times the length of the outermost, the shafts are pliant

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JOURNAL
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MAR. 1917. VOL. XXV. NO. 1.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U.

PART XXI.

With a Coloured Plate.

PHASIANIDÆ.

Genus—*GALLUS*.

The Genus *Gallus* contains the true Jungle-fowl, of which there are four species entirely confined to the Indo-Malayan region. Jungle-fowls are closely allied to the true pheasants, like them the sexes differ in plumage, the males greatly exceed the females in size, and their haunts are well-wooded tracts with an ample water supply. The principal external difference is in the tail which in the Jungle-fowl is sharply compressed whereas in the true pheasants it is flat; it is linked however with these latter by many intermediate forms such as *Gennæus*, containing the Silver and Kalij Pheasants, *Crosoptilon* or Eared Pheasants, etc., in which the tails are almost as compressed as in the Jungle-fowl.

The males are all furnished with a fleshy crest or comb and with wattles or lappets either hanging from each side of the throat, as in all three of the Indian species, or with a single one from the centre of the throat as in the Sunda Island bird, *varius*. The tail consists of fourteen feathers in our three species and of sixteen in the last mentioned bird. The wings are well rounded, the first primary being shorter than the tenth and the fifth the longest. The central tail feathers in the male are greatly lengthened, being from three to four times the length of the outermost, the shafts are pliant over the greater portion, and the feathers droop in a graceful curve when the tail is raised. The feathers of the neck and rump are long and lanceolate, forming hackles, the latter falling well down on either side of the tail. The legs are very powerful, and the tarsus, which is furnished with a long shaft spur, is longer than the middle toe and claw together. The females have no spur.

KEY TO SPECIES.

A.—Comb and spurs highly developed.	
a. Neck-hackles red or golden-red with no spots.	
*a*¹. Breast black	*G. bankiva* ♂.
*b*¹. Breast reddish orange	*G. lafayettii* ♂.
b. Neck-hackles blackish with golden bars or spots	*G. sonnerati* ♂.
B.—No spurs and comb rudimentary.	
c. Breast rufous-brown with faint pale shaft lines	*G. bankiva* ♀.
d. Breast mottled brown and black and white	*G. lafayettii* ♀.
e. Breast white, each feather edged with brown	*G. sonnerati* ♀.

There are two very distinct races or subspecies of the Common Red Jungle-fowl inhabiting the one India proper excluding the Indo-Burmese districts and the other extending through Burmah, the Malay Peninsula, Cochin, China and Siam. In the outer Burmese Indian districts of Eastern Assam and Chittagong we find, as we should expect, an intermediate form between the two.

The Indian form may at once be known by its pure white lappets, the Burmese form having these red, but there are other differences also, the Indian bird, the true *ferrugineus*, has the hackles of the neck of a red much less deep than they are in the Burmese bird, moreover they are far more yellow or orange-yellow at the base of the neck, and in addition are more lanceolate, the Burmese form often having the ends comparatively broad instead of produced to a very fine point.

Hume recognised the differences between the Burmese and Indian bird, and thus writes of them :—

> "I have referred to the Indian and Burmo-Malayan races of "this bird. The plumage of the latter is said to be redder, "and taking a large series there seems to be some truth in "this, though individual birds from Dehra Dun and Johore, "for instance, can be entirely matched as regards plumage, "but in the Burmese and Malayan birds, the small ear lappet "is invariably *red*, whereas in the Indian it is almost equally "invariably *white* or *pinky white*."

The Burmese form will be known as *Gallus bankiva bankiva*, Temm.

KEY TO SUB-SPECIES

A.—Ear lappets white .... *G. b. ferrugineus.*
B.—Ear lappets red........................... *G. b. bankiva.*

The Red Jungle-fowl is generally accepted as the original ancestor of the domestic fowl, but there is really nothing to prove this beyond the fact that the wild Red Jungle-fowl is extremely close in appearance to the domestic bird of the Game-cock strain. On the other hand Seabrights pencilled Hamburgs and many other domestic strains which are known to be of artificial origin are much more like the Grey Jungle-fowl than the Red. Remains of extinct and fossil birds placed in the genus *Gallus*, have been found in many countries in Europe and also in New Zealand, which date back to the Pleocene and Pleistocene periods and the most that can be said concerning the origin of the domestic fowl is that it is probable that its immediate ancestor may have been something like the Red Jungle-fowl.

I have followed Blanford in not accepting *Gallus gallus* as the name of the *Wild Indian* Jungle-fowl, but as *bankiva* is an older name than *ferrugineus* the species must be known by this name, the Indian race or sub-species taking the trinomial *ferrugineus*.

[GALLUS BANKIVA FERRUGINEUS.

The Common Jungle-fowl.

Phasianus gallus.—Linn, Syst. Nat. I, p. 270 (1766).

Gallus bankiva.—Jardine, Nat. Lib., Orn. iv., p. 175, pl. (India); Hodgs. in Gray's Zool. Misc., p. 85; Gray, Cat.; Hodgs. Coll. B.M. ed. i, p. 125; Adams, P.Z.S., 1858, p. 498; Blyth, Ibis 1867, p. 156.

Gallus ferrugineus.—Blyth, Ann. Mag. N. H. XX, p. 387 (1847); *id.* Cat. Mus. As. Soc., p. 242; Adams, P.Z.S., 1859, p. 185; Irby, Ibis 1861, p. 234; Jerdon B. Ind. iii., p. 536 (part); Blyth, Ibis 1887, p. 154 (part); Beavan, Ibis 1868, p. 381; Brooks, Ibis 1869, p. 60; Bulger, Ibis 1869, p. 170; Elliot, Mon. Phas. ii., p. 184, pl. 32 (part); Hume, N. & E., Ind. B. p. 528 (part); Ball, Str. F. II., p. 426; Hume, Str. F. ii., p. 482 (part); Blyth and Walden, Cat Mam & B. Burma, p. 149; Hume Str. F., ibid III., p. 171; Armst. IV., p. 338; Hume and Inglis, ibid V., p. 44; Oates, ibid V., p. 164; Wardlaw-Ramsay, Ibis 1877, p. 468; Marshall B. Nest Ind. p. 59; Hume and Marshall, Game B. Ind. 1., p. 217 pl.; Anders, B. W., Yunnan, p. 669; Hume and Davison, Str. F. VI., pp. 442, 521, Ball., ibid VII., p. 225; Hume, ibid, VIII., p. 68; Scully, ibid, VIII., p. 348; Bingham, ibid IX., p. 195; Fasson, ibid, IX., p. 205; Oates, ibid, X., p. 236; Marshall, Ibis 1884, p. 423; Taylor Str. F. X., p. 531; Hume, Str. F. XI., p. 304; Oates, ed. Hume's Nests and Eggs. III., p. 417 (part); Blanf., Avi. Brit. Ind. IV., p. 75 (part); Sharpe, Hand-L. B. I., p. 39 (part); Stuart Baker, Jour. B. N. H. S. XII., p. 436 (1899); Inglis, ibid, p. 676 (1899); Fulton, ibid, XVI., p. 61 (1904); Ward, ibid, XVII., p. 944 (1907); Inglis, ibid, p. 971 (1907); Magrath, ibid, XVIII p. 298 (1908); Osmaston, ibid, XXII, p. 544 (1913).

Gallus gallus.—Ogilvie-Grant, Cat. B. B. M. XXII, p. 344 (part); *id.* Hand-L. Game B. II, p. 48 (part); Oates, Journ. B. N. H. S., X., p. 106; *id.* Game B. of In. (part) I.; p. 366.

Vernacular Names.—Jungli Murgha, Bun Murgha ♂, Jungli Murghi, Bun Murghi ♀ (*Hin. Upper India*); Bunkokra, Bunkukra, (*Bengali*); Bun kukur (*Assamese*); Natsu-pia, Magse-ya (*Bhutia*); Pazok-tchi, Tangkling (*Lepcha, Sikkim, Dooars*); Bir-sim (*Koles*); Gera-gogor ♂, Kuru ♀ (*Gonds*); Lall (*Chanda Dist.*); Ganga (*Uriya*); Daono (*Cachari*); Vok (*Kuki*); Inrui (*Kacha Naga*).

Description—Adult Male.—Crown of the head, nape and upper mantle, together with the sides of the neck, deep bright orange-red, changing to reddish gold or orange on the longest hackles, which are marked with black down their centres; upper back, below these long hackles, black glossed with Prussian blue or green; lower back deep maroon red, highly glossed and gradually changing into fiery orange on the long hackles of the rump; these latter are more or less centred with black, the centres, however, being concealed by the overlying feathers; upper tail-coverts and tail-feathers black brilliantly glossed with green, blue-green or copper green; the blue generally dominant, on the coverts, and the gloss absent or slight on the outermost tail feathers. Smallest wing coverts, and shoulder of wing black, glossed like the back with blue or blue-green, or purple-blue; median wing coverts like the lower back; greater coverts black like the smallest; quills dark brown, in some specimens almost black; the primaries edged on the outer web with light cinnamon and the secondaries with the whole of their visible portions of this colour except the innermost which are of a glossy blue-green with only a part of the outer webs cinnamon.

Under plumage, under wing-coverts and under tail-coverts deep brown or blackish, faintly glossed with green.

Colours of soft parts.—Irides varying from reddish brown in the young bird, through red to bright orange red in old males. Comb generally a bright scarlet crimson, sometimes duller, more red and sometimes almost a brick-red; wattles the same in colour, but sometimes a more livid red; ear lappets white, sometimes touched with pinkish on the lower posterior portions, especially in Assam birds; skin of face, throat and upper neck red, generally of a rather bluish or fleshy tint; legs vary between greenish grey and a deep slaty brown, every intermediate tint being met with, the most common colour being a rather dark plumbeous with a faint tinge of brown or purple; the spur is always more or less brown, almost black at the tip. Bill dark horny brown, the gonys and tip of the lower mandible paler and the former often reddish. The colour of the comb and wattles is much brighter in the breeding season than at other times, both in the male and female, just as it is in barn-door hens when they are in full laying.

Measurements.—Wing 8″ (203·2 mm.) to 9·6″ (243·8 mm.); tail anything between 12″ (304·8 mm.) and 15″ (381·0 mm.); tarsus about 3″ (76·2 mm.) or rather more; bill from gape about 1·25″ (32·6 mm.) and from front about ·80″ (20·3 mm.); the spur is generally about an inch (25·4 mm.) but I have seen one or two specimens with spurs a full 2″ (50·8 mm.). Weight, according to Hume, 1lb. 12ozs. to 2lbs. 4ozs., but one male shot by me in Cachar weighed only just short of 3lbs. and two or three others well over 2½lbs. The majority weight just under, rather than over, 2lbs.

Post nuptial plumage.—The cock Jungle-fowl has a sort of post nuptial plumage caused by the moult of the neck hackles and the long tail feathers, the former being replaced by short blackish brown feathers. Often these same blackish feathers may be observed in patches on other parts of the body, principally the back and wing coverts. These feathers probably replace others lost by accident or some other abnormal cause.

This post nuptial plumage is interesting in that it corroborates the theory that all extraordinary colouration or shape in any portion of a bird's plumage is due to excess vitality and with a drop in the vitality to a sub-normal condition sombre colours or normal shaped plumage is assumed. In many cases this post nuptial plumage is never assumed and cock birds may be shot all the year round in perfect feather. When assumed it is most irregular and may be found in any month between May and October, though generally the hackles are dropped in June and July and reassumed in the September-October moult.

Immature Male has the hackles less developed both on neck and rump, and the black centres to these feathers comparatively broader and far more visible; as a rule also the neck hackles are more yellow and less deep orange in tint. The cinnamon of the wing quills is darker, and the whole of their surface except at the basal halves of the outer webs are finely powdered and vermiculated with blackish; the greater-wing coverts are also more or less powdered in a similar way.

Colours of soft parts.—Iris brown, or reddish brown; wattles and undeveloped comb duller than in the adult, and skin of face bluish or leaden colour.

Quite young Males in their first feathers are similar to females of the same age.

Adult Female.—Top of the head blackish brown, the feathers broadly edged with golden yellow. In most birds the forehead is more or less metallic crimson and this colour is produced backwards as supercilia above and behind the ear coverts whence they widen and meet on the foreneck in a broad gorget. In some specimens the red will be found to occupy nearly the whole of the fore crown and to deepen the yellow of the posterior crown to a deep orange. Feathers of the nape orange yellow, with broad blackish centres, changing to pale golden yellow on the longer hackles along the back. Upper plumage, wing-coverts and inner secondaries reddish buff or reddish brown, the feathers with pale shafts and vermiculated all over with black or very dark brown; primaries deep brown or brown, sometimes edged on the outer web with rufus. Tail blackish brown, the central tail feathers more or less mottled with rufus, which in some cases extends to the next two to four pairs of feathers on their outer webs. Breast below the red gorget light Indian red with pale shafts, gradually becoming paler and duller on the lower breast, and shading into pale dull cinnamon on the belly, much vermiculated with brown; under tail covers black or blackish brown.

Colours of soft parts.—Iris brown or hazel; bill horny brown, gape and lower mandible plumbeous fleshy or fleshy grey; comb and orbital skin reddish crimson; wattles very rarely present and very small, like the comb but paler and more livid, legs generally dull plumbeous brown but varying in tint as in the male. Undeveloped spurs are occasionally present. Tickell obtained such a specimen in Singhbhum and I have myself shot at least half a dozen females showing spurs, which in one case exceeded half an inch in length.

Measurements.—Wing 7″ (177·8 mm.) to 7·7″ (195·6 mm.); tail from vent 5·5″ (139·7 mm.) to 6·5″ (165·1 mm.); tarsus about 2·5″ (63·5 mm.); bill from front about ·75″ (19·5 mm.) and from gape about 1·1″ (27·9 mm.)

"Weight 1lb. 2ozs. to 1lb. 10ozs."—(Hume).

Young females in their first year are generally more yellow buff and less red below and have the feathers boldly mottled with brown on the breast and lower parts. The extent of the crimson or rusty-red of the head is also a sign of age, though a few females seem never to acquire this.

Chick in down.—A broad band down from the centre of the crown to the end of the back a rich plumb brown; a streak of similar colour from the posterior lores produced in a fine line over the eyes and as a wide line down the sides of the neck; lateral bands of buff down each side of the back succeeded by other bands of the same colour at the centre.

Sides of the body rich warm reddish buff changing to pale buff on throat, foreneck and centre of breast and belly.

The wing feathers when they first appear are isabelline finely vermiculated with black, the quills gradually becoming more or less immaculate on the inner webs as they grow larger.

The bills are fleshy yellow and the legs rather clear olive greenish.

Distribution.—Hume's very full note on the distribution of the red jungle-fowl leaves little to be added. Eliminating the areas in which the Burmese form occurs his summary is as follows :—

> "Throughout the lower ranges of the Himalayas, the "Dhuns Tarais, and submontane districts and the Siwáliks "from the southern outer ranges of Kashmir to the extreme "head of the Assam Valley beyond Sadiya.
>
> "Throughout the whole of Assam including the less "elevated portions of the Cáro, Khasi and Nága Hills, Cachar "and Sylhet, the whole of Eastern Bengal, including the "Sunderbans. Again in the hilly portions of Western Ben"gal from the Rajmehal hills, through Midnapore, and "westward of this, through the whole of Chota Nagpore, and "the northern and eastern portions of the Central Provinces, "it is the only jungle-fowl that is found. It is common "along the Kymore Range, and extends northwards to the "neighbourhood of Punnah and Chairkhari, and south"wards on the Maikal or Amarkantak Ranges.
>
> "Southwards and eastwards of these latter, it occupies the "whole country north of the Godávari, Orissa, the Tributary "Mahála, Ganjam, Vizagaptam, and part of the Godávari "District, Joonagurh, Kareall, Nowagurh, Jeypore and "other Feudatory States. It occurs also immediately below "Pachmarhi."

Forsyth has shewn that the habitat of this jungle-fowl is practically that of the Swamp Deer (*Cervus duvauceli*) and of the Sal-tree (*Shorea robusta*) and a curious corroboration of this is the occurrence of all three of these in the Deinwa Valley, near Pachmarhi, although there is an intervening country of some 150 miles eastward before the three are again met with. At the same time it must be noted that the Red Jungle-fowl does not occur in Bhawalpore and Sind where the Swamp Deer is found, though not the Sal-tree.

Nidification.—The Red Jungle-fowl breeds, over the whole of its habitat, the season apparently not varying much in different localities as it does with some birds. Thus even in the hot, dry portions of the Central Provinces and Punjab, etc., they appear to lay from April to June, not waiting until the bursting of the rains ensures more food and a cooler temperature. At the same time it is certain that although the months just mentioned may be the principal breeding months a much wider margin of time than is covered by these must be allowed for their nidification. I have personally taken their eggs in the Santhal Perganas, Chota Nagpore, Assam and Cachar in every month of the year except October, November and December. In the last mentioned month, however, I have seen just hatched chicks, so it would be unsafe to exclude any month of the year from their breeding season. In Assam undoubtedly most birds lay in March and April, many in February and June and the rest at odd times throughout the year.

I have not known them breed above 6,000 feet, but have taken eggs at this height in the Assam Ranges, and have received a clutch of 8 eggs taken at Simla at this height by Mr. P. Dodsworth, whilst in the Naga Hills and hills in the extreme east of Assam they are found up to 7,000 and even 8,000 feet in summer, and almost certainly breed at this elevation.

They nest in practically any kind of jungle, but undoubtedly prefer for this purpose the dense tangle of secondary growth which is found in deserted cultivation clearings. Next to this kind of jungle, bamboo forest which is dense and which has some undergrowth appears to be a favourite resort and, thirdly, broken hills well covered with dense bush and tree forest. As regards the nest, this may be either a depression scratched in the ground by the birds or a natural hollow sometimes devoid of all lining, or, on the other hand, well lined with fallen leaves and rubbish. Sometimes there is no hollow even, and the eggs are just laid on the ground under the protection of a bush or clump of bamboos, whilst often a mass of leaves, grass and rubbish is collected in a heap, a hollow formed in the centre, and the eggs laid therein. I have also taken several nests made in the centre of bamboo clumps, the eggs being deposited in the mass of leaves and rubbish which always fill up the inside of these clumps to a height of two to four feet.

As a rule the nests are well concealed, especially where they are made in secondary growth, but I have more than once found them so placed that they could be seen from some feet away without any search having to be made for them. One such nest was placed on the ground in a shallow green mossy ravine running through evergreen forest. A certain amount of dead leaves, bracken and moss had been collected in a depression, whence a large stone had been turned out, and on these the eggs were laid, conspicuous from about 20 feet in every direction, except from the point at which they were screened by the boulder which still lay where it had been thrown on one side. Another quite unconcealed nest lay in a very open bamboo jungle, in a small bare space where nothing grew and here on a few dead bamboo leaves lay the five eggs, saved from molestation only by their resemblance in colour to the bamboo leaves.

The period of incubation appears to be 20 days, equivalent in tropical countries to the 21 days the domestic fowl takes to hatch her eggs in more temperate regions. The hen sits close, and when forced to leave, creeps away silently through the jungle more like an animal than a bird, though occasionally when very suddenly disturbed she may get up with as much fluster and fuss as a barndoor fowl.

The number of eggs laid is generally 5 to 8, rarely 9, and whilst 5 or 6 is undoubtedly the usual full complement, often only 4 are laid. Some hundreds of clutches have passed through my hands, or have been actually seen by myself in the nests, and Dr. H. N. Coltart must have seen almost as many, but neither of us have ever known more than 9. Jerdon states that they sometimes lay as many as a dozen, but his zoological notes are not very correct, and he, like many others, who have made similar statements as to the number of eggs laid, have been probably misled by natives. In appearance the eggs cannot be discriminated from those of the common Indian domestic fowl, and only differ from those of the English birds in being so much smaller. They vary in colour from almost pure white merely tinged with cream to a deep cream buff or *cafe-au-lait* tint like that of a Brahma fowl's egg. Now and then one comes across a deep coloured set of eggs covered with white specks and spots, and I once had a clutch of bright pink-buff eggs marked with white blotches and spots over the larger half.

In length 200 eggs vary between 1·56″ (39·6 mm.) and 2·05″ (26·6 mm.), whilst in breadth the extremes are 1·27″ (32·2 mm.) and 1·62″ (41·1 mm.) The average of 200 is 1· 82″ (48·2 mm.) by 1· 40″ (35· 5 mm.)" It will be seen that the average size of my eggs is a good deal larger than those of Hume, but is slightly less than those of the British Museum, according to Oates.

So many writers have constantly asserted that Jungle-fowl hens always cackle and call after laying an egg in the same way as the domestic bird does that I cannot pass over the subject without reference. Having read Tickell's and Rainey's remarks in Hume's "Game Birds" I made the most careful investigations, and must say that I have found nothing to support their assertions. It is true that time after time I have heard hens cackling and shouting as if full of pride at the recent achievement of laying an egg, but have never yet been able to find the egg so laid. Again, I have often heard hens when not breeding calling in the same manner, and sometimes several birds in one flock all giving vent to their feelings at once. As a rule I am quite sure the cry is the result of some fright and is merely the hen's way of expressing indignation and not pride. A tiger or leopard stalking through the jungle will often be abused in this manner, and even a jackal may be the mean cause of a similar commotion; often myself when out shooting and stealthily going through the forest I have suddenly come on one or more hens who, after flying a short distance have relieved their feelings by loud and prolonged cacklings. It seems hardly possible that a wild bird full of anxiety for its future young should announce to all the predatory world "here is an egg, come and eat it." It was this inherent improbability in the idea that first made me investigate it, and I have no doubt that there is no foundation for it in fact.

Another common theory which there seems good reason to doubt is that Jungle-fowl are always polygamous. Hume draws attention to this and says :—

> "Lastly, I am quite certain that they are not always "polygamous. I do not agree with Hutton that they are "always monogamous, because I have constantly found "several hens in company with a single cock, but I have also "repeatedly shot pairs without finding a single other hen in "the neighbourhood."

There is, however, a good explanation of the first mentioned condition of affairs, for I think that the young cocks leave the family circle before the young hens do, and in consequence the male parent may often be seen in company with half a dozen hens and no cocks, so that whilst one seldom finds hens wandering about by themselves, unless they are incubating eggs, one often comes across young cocks, either quite alone or with one other young cock of like age; probably a brother. It may be that the old cock drives off the young birds, but it is more likely that the latter being of a more roving, independent nature, clear off sooner than the hens.

General Habits.—Jungle-fowl may be found in practically any kind of country in which there is sufficient cover, but there is little doubt that they prefer country consisting of shallow valleys, low hills and broken ground at the foot of big hills rather than open plains country or the higher hills. As already mentioned, they may be found up to, or even over, 6,000 feet, but they are mere stragglers to such heights, and it is below 2,000 feet rather than over that we must look for them if we want them in number sufficient to make the shooting of them a regular business. Another undoubted attraction is cultivation when it borders on forest or bamboo jungle; nor does it seem to matter much what the cultivation is, whether grain, rice, mustard, cotton or chillies. Any kind of crop seems to offer food either in itself, in the insects it attracts or in its semi-open patches which supply an easy hunting ground.

Jungle-fowl are extraordinarily numerous in the Garo, N. Cachar and other hills south of the Brahmapootra, and it is often possible to see hundreds in a morning's or afternoon's wandering. Once when shooting on the Kopoli River, a stream which divides the Khasia and N. Cachar Hills, I must have seen fully 500 birds during the day. It was then early in March, and the flocks of birds had not yet broken up into pairs to commence breeding, and every afternoon and evening they frequented the long stretches of mustard field which run along the banks of the stream. Although nowhere wide, seldom over a hundred feet or so, these patches often ran for half a mile or more without the break of a patch of forest, and they formed simply ideal feeding grounds for every kind of game, from the Jungle-fowl and barking-deer to elephants and buffaloes. The mustard was high enough to afford good cover, so that in spite of the wiliness of the birds it was possible to obtain quite a good bag by wandering along inside the edge of the jungle, whilst a couple of men beat through the mustard about 20 yards behind one. On the morning in question, whilst the sun was still invisible I had got to the first patch and was about to start along the edge of the forest whilst my men did the beating, when I caught sight of a barking-deer coming out of it and a snap shot with my express turned it over and so commenced a lucky day's shoot.

The shot, however, disturbed every thing close by, so as we were only a few hundred yards from the camp, I sent one man back with the deer and waited for his return. By this time the birds had regained confidence and were out feeding once more and we had hardly started our beat before about a dozen Jungle-fowl were up with a tremendous fluster, and had dived headlong into the forest, leaving a fine old cock on the ground, whilst another bird escaped with a bad scare. A hundred yards further on a second but smaller lot were flushed, and again resulted in a miss and a hit, another cock being added to the bag. After this a quarter mile's slow trudge showed nothing but a glimpse of a couple of hens as they scurried on foot into the undergrowth, too far way for a shot then a single cock gets up and is missed and within another 200 yards I managed at last to bring off a clean right and left at two hens, the last of a lot to get away out of the mustard. This sort of thing goes on until by about 9-0 a.m. I have got to the end of the cultivation, and have collected 8 Jungle-fowl, a couple of Kalij Pheasant and one Barking-deer, and have expended some 20 cartridges. Of course the great majority of birds have got up well out of shot, and in one stretch of about half a mile of mustard well over 200 birds must have been flushed without my firing off my gun once. In fact the majority of shots obtained were from tiny patches of mustard which lay so snuggled in the forest that the birds could not see us until we emerged from the forest tract into the cultivation. Even in there, however, as often as not we failed to obtain a shot, though the birds were there in numbers. All we saw as we peeped out of our leafy cover would be the last of a flock as it disappeared, an old cock bringing up the rear of his family, tail and head down as he ran for all he was worth into safety. Of course, on such occasions when it was possible a running shot was taken, and when shooting without dogs and especially when shooting to feed oneself and a hungry crowd of coolies, it is absolutely legitimate to do so or else go without any dinner.

Jungle-fowl are just as great skulkers and runners as are nearly all other tropical game birds of the Pheasant tribe, and almost invariably prefer to seek safety on their legs rather than by wing, in fact except when one has good dogs or can work cultivated ground as above, it is absolutely impossible to get the birds to rise unless a regular beat is organised.

We used to have quite good shooting for from 4 to 6 guns in the N. Cachar Hills with a line of 20 to 40 coolies. Our method used to be for the guns to keep well ahead of the beaters along jungle paths or the beds of streams, a gun on either side of these latter when possible, whilst two other guns went along the extreme wings of the lines. In the mornings and evenings the birds were always found low down in the valleys near the water, and very favourite haunts were the numerous scrub covered islets which were dotted all along the stream. The line of coolies worked down the stream and about a hundred or two hundred yards up the sides of the hills on either side. The birds generally ran some distance in front of the shouting line of coolies and then broke across the stream, flying up the opposite hill and so giving real sporting shots at good distances. In this way we would sometimes get 30 or 40 birds in a morning and evening, chiefly Jungle-fowl but with a few Black-backed Kalij, an old bambooo partridge or so and perhaps a deer thrown in.

The Jungle-fowl is not an easy bird to kill and flies far faster and takes much straighter powder then a novice would imagine. A friend of mine who came out to India with the well-deserved reputation of being a real good pheasant-shot, at first when asked to do so absolutely refused to go out and shoot barn-door fowls, as he called them. He was, however, eventually induced to go out after Kalij Pheasant, and in the course of this shoot succeeded in firing well behind several Jungle-fowl which were put up to his gun. After this we heard no more contemptuous remarks against them, although, once he had taken their measure he became as fine a shot at these birds as at our home pheasants.

I have never been present at any very big shoots at Jungle-fowl, our shoots being merely scratch affairs got up at a moment's notice when we could get a day or half a day off work, but the railway officials under the leadership of Mr. Vernon Woods used to have an annual Jungle-fowl shoot at which very big bags were made.

A great charm about Jungle-fowl shooting, whether in big beats or alone with a couple of shikaries or beaters is the wonderful variety of game one meets with, both large and small.

It is many years now since Hume warned Griffs as to the necessity for being prepared for any eventuality when shooting small game in heavy jungle, and this warning holds good now just as it did then. Hume describes how when out Jungle-fowl shooting in 1853 he once ran into a party of four bears, and was at once charged by an old female whom he succeeded in killing, but at such close quarters that he and the bear all fell over together.

More than once I have had to shoot surely old boars who resented my intruding on to their feeding ground and once when I had foolishly left my rifle behind when going for an evening's stroll I had to retire in haste, whilst an ill-tempered cow buffalo grunted and pawed the ground in the middle of a mustard patch I wanted to shoot through. On another occasion I had a still more narrow squeak, walking straight on to a tigress engaged in finishing her meal off a wretched Mikir coolie whom she had killed. She was fortunately full and apparently did not quite understand what the object in front of her was, and eventually was good enough to make off, but as I only had a shot gun in my left hand and was too near her to risk changing it into my right, it was with no small relief I saw her leap to one side and rush away through the grass. The next year, curiously enough, when again Jungle-fowl shooting in the same place, I again saw her, this time at a safe distance, and was enabled to add her to my string of Jungle-fowl and Pheasant.

The crow of a Jungle-cock is quite a game wild sound, very like that of the game bantam; it is, however, always recognisable by its shrill yet full note, and, above all, by its very abrupt termination. In the domestic bird the last note is the one usually prolonged and most dwelt upon, whereas in the wild bird the last note is the shortest. Even in those parts of its habitat where the domestic birds are for the most part so constantly crossed with wild birds that they are to all intents and purposes of the same breed I think the full abrupt note of the really wild bird can be always recognised.

They do not crow much during the cold weather, though even in these months an odd bird or two may be heard throughout the day, whilst nearly every bird within hearing will be heard calling every morning and evening. In the breeding season, however, they not only crow several times just before daybreak and after sunset, but they crow constantly during the day, and are only quiet for the hottest hours between noon and three or four o'clock.

During the breeding season, they do occasionally crow when strutting about on the ground, breathing defiance against every other cock in the neighbourhood, but as a rule they mount some convenient stump, or perch on a bamboo or tree branch and from this point of vantage challenge other birds to mortal combat with many crowings and flapping of wings.

Even, however, when they announce their presence thus to any sportsman who may be near, they are so wily and so sharp of hearing that it takes a very careful stalk to enable one to get a shot.

The slightest snap of a twig or rustle of a leaf and, even is in the middle of a crow, it collapses, and when you arrive the bird has gone. About the only time a Jungle-cock can be caught unawares is when he is fighting, and then, so intense is his interest in the business on hand that I have known them caught by natives simply throwing a cloth over the two struggling birds.

They are quite as pugnacious in their wild state as any breed of game cocks, and often fight to the death, indeed on some occasions until both birds are *hors-de-combat*. One such occasion came within my own knowledge when my coolies picked up a dead Jungle-cock on the forest path, and just beside it another cock, blinded and so weak that it made no attempt to escape when caught and died before it could be brought into camp. They will also fight with pheasants and other birds, and I was once fortunate enough to see the whole of a fight between a Jungle-cock and a Black-backed Kalij.

At the time this occurred I was seated behind a bamboo clump in a thicket of low bushes watching a Mikir attempting to call up Jungle-fowl. We had been there about ten minutes when his calls—made to simulate a hen chuckling and scratching about for food—attracted a cock who replied by crowing for two or three minutes, after which fluttering down from his bamboo perch, he strutted into the small open piece of ground immediately in front of us. At the same moment a fine cock Kalij also came into the open about five paces away, and without a second's hesitation the cock rushed at him, and taking him unawares bowled him over. The pheasant was, however, much the bigger bird of the two and apparently unhurt, though somewhat confused by the rush tactics of his enemy, at once took up the gauntlet. For a few seconds the two birds faced one another, beaks low down to the ground and tails raised, and then like lightning the Jungle-cock rose and jumped over the pheasant, striking lustily as he passed and making the feathers fly.

No real damage was done by this, and the pheasant wheeling once more faced his active little adversary. Again the two birds walked round like a couple of pugilists, watching intently every movement of the other; heads never more than a couple of feet apart, until one or the other made his effort, with varying success, to pass over the other bird striking as he leapt.

Similar proceedings went on for the next ten minutes, the pheasant occasionally taking the offensive, but seldom with any effect. By sheer weight he now and then succeeded in bowling over his enemy, but slowness in taking advantage of his momentary success always enabled the Jungle-fowl to slip away and again attack. At the end of the time mentioned it was a weary and bleeding pheasant which faced a still alert and fresh Jungle-fowl;

for a few more minutes however he still stuck to his guns, but then turned and fled, only to be at once caught and knocked over again and again as he tried to escape; finally as he again turned to bolt, the cock struck fair, and his spur went right into the nape of the neck, and before he could disentangle himself from his victim, both birds were covered by the Mikir's blanket. When we got them out of the folds of this the pheasant was dead, whilst the cock was almost unharmed beyond a broken spur and a torn comb. To the Mikri's indignation I insisted on the release of the winner of the fight, who at once scuttled off into the bamboos and when at, what he considered, a safe distance flew into a branch and crowed victoriously.

Although I have so frequently come across the birds when fighting, I have never come across a regular fighting ground such as that described by Hume. He writes:—

> "No one specially notices the extreme pugnacity of these "birds in the wild state, or the fact that where they are "numerous they select regular fighting grounds much like "Ruffs.
>
> "Going through the forests of the Siwáliks in the north-"eastern portion of the Saharanpur district, I chanced one "afternoon, late in March, on the tiny open grassy knoll, "perhaps ten yards in diameter and a yard in height. It "was covered with close turf, scratched in many places into "holes and covered over with Jungle-fowl feathers to such an "extent that I thought some Bonelli's Eagle, a great enemy "of this species, must have caught and devoured one. Whilst "I was looking round, one of my dogs brought me from some-"where in the jungle round a freshly killed Jungle-cock, in "splendid plumage, but with the base of the skull on one side "pierced by what I at once concluded must have been the spur "of another cock. I put up for the day at a Bunjara Perow, "some two miles distant, and on speaking to the men found "that they knew the place well, and one of them said that he "had repeatedly watched the cocks fighting there, and that he "would take me to a tree close by whence I could see it for "myself. Long before daylight he guided me to the tree, "telling me to climb to the fourth fork, whence, quite con-"cealed, I could look down on the mound. When I got up "it was too dark to see anything, but a glimmer of dawn soon "stole into the eastern sky, which I faced; soon after crow-"ing began all round, then I made out the mound dimly, "perhaps thirty yards from the base of the tree, and forty from "my perch; then it got quite light, and in a few minutes "later, a jungle-cock ran out on to the top of the mound and "crowed (for a wild bird) vociferously, clapping his wings,

"and strutting round and round, with his tail raised almost "like a domestic fowl.

"And here I should notice that although, as has often been "noticed, the wild cocks always droop their tails when running away or feeding—in fact almost whenever you see them "—yet I believe from what I then and once subsequently "saw, that, when challenging rivals, they probably always "erect the tail, and I know (having twice so surprised them "before they saw me when watching for Cheetul and Sambur "from a machàn, near water in the early morning) that when "paying their addresses to their mates, they do the same during "the preliminary struts round them.

"I learned so much and no more; there was a rush, a yelp; "the jungle-cock had vanished, and I found that one of my "wretched dogs had got loose, tracked me, and was now "careering wildly about the foot of the tree.

"Next day I tried again, but without success. I suppose "the birds about had been too much scared by the dog, and I "had to leave the place without seeing a fight there; but putting all the facts together, I have not the smallest doubt "that this was a real fighting arena, and that, as the Bunjara "averred, many of the innumerable cocks in the neighbourhood did systematically fight there."

In the Sunderbans, where, as Rainey and Hume both believed to be the case, most, if not all, the birds are derived from tame stock; they are often caught by the cultivators who use a tame cock as a decoy spreading nooses round about him in which the wild birds who come to answer his challenge are caught. This method which is described by Rainey and quoted by Hume is the common way of catching Jungle-fowl over practically the whole of their habitat, but the hill tribes often catch them by nooses just set about and around some small patch which they bait with grain.

They are very hard birds to domesticate, if kept in confinement they soon pine away and die, and if allowed to run about with the farmyard birds they nearly always clear off the following breeding season, though they may continue to haunt the vicinity for some time, months even, after they first take their departure. At the same time they often haunt the vicinity of villages attracted, of course, by the surrounding cultivation and by the droppings of grain, etc. In such cases it is no uncommon thing for a cock to take up his abode in some tree or bamboo clump in the immediate outskirts of the buildings, where he sleeps at night and daily visits the domestic hens as they wander about in the cultivation. The tame cocks seldom attempt to resent his appearance, and when they do they generally get such a trouncing that the attempt is not made twice. It is curious that although in some villages the hens are so continually crossed with the wild cocks that to all intents and purposes the birds are nothing but wild birds pure and simple, yet the cocks never have the same robustness and fighting ability as the actual wild ones. In appearance they are one and the same birds until one examines the spurs and then it is seen that the spur of the wild bird is generally far longer, finer and cleaner than that of the village bird. One seldom meets with the short bulgy spur in a feral state and the texture also seems to be much harder and closer and naturally, as a weapon, is far more effective.

The strength and vigour with which the Jungle-cock can use his spur is really astonishing; in addition to the cases already mentioned in one of which the neck vertebræ were severed and in the other the eye and brain pierced, I have more than once known them to drive the spur full into their opponent's brain behind the comb, and on another occasion found a cock with his wing broken at the carpal joint. Sometimes so fierce is the blow given that the spur itself gets broken or torn away, and once that is done the owner is no more of use in the ring, however great his pluck and determination.

In spite of what Hume says to the contrary, for the table the qualities of the Jungle-fowl must be rated nearly as high as his pugilistic attributes. When shot round about villlages he may sometimes be found to be a foul feeder, though this is not my own experience, but normally his flesh is excellent, even old birds are comparatively tender and sweet, except for their legs, whilst birds of the year are much better eating than are Kalij Pheasants of the same age. Like all game birds they are all the better for hanging when the climate permits, but when it is impossible to keep them for two or three days they should in the alternative be plucked, cooked and eaten as soon as possible after being killed.

Like the domestic fowl the Jungle-fowl is practically omnivorous, but is by preference rather a vegetarian than an insect eater. All kind of seeds, grain, etc., are greedily devoured, and also many kinds of roots, buds and young shoots. Bamboo seeds are a very favourite food, and where there are stretches of bamboo which have seeded and the seeds are beginning to fall, these birds—and others—collect in almost incredible numbers into a very small area. I have known them eat in addition to their ordinary seed and grain diet, worms and small lizards, insects of all kinds, tadpoles out of a little backwater in a hill stream, and, once, I saw a hen rushing about with a small grass snake in her bill pursued by two other Jungle-fowl. Whether they would have finished the snake or not cannot be said, as my appearance on the scene dispersed the meeting. They are very fond of all kinds of wild figs and berries and also of the mowa flower when this ripens and falls to the ground.

As a rule Jungle-fowl feed almost entirely on the ground, scratching about, turning over leaves and fallen rubbish and hunting for their food just as the domestic bird does in the back yard, but I have more than once disturbed them feeding in the Pepul and Banyan trees, scrambling about on the branches and picking the fruit as they go. They are extremely clumsy birds when thus employed, and seem to easily lose their balance and fall over.

The young birds fly within a very few days of hatching, and when the hen is forced to take wing follow her well and seem to have no difficulty whatsoever in keeping pace with her. At this stage of their development their wings appear to be very large in proportion to their bodies, and their flight is very quiet and soundless compared with the noisy flight of the adult bird.

GALLUS BANKIVA BANKIVA.

The Burmese Jungle-Fowl.

Phasianus bankiva.—Raffl., Trans. Soc., Linn. XIII, p. 319, [Sumatra] (1822). Grand Gaille de la Chine.

Sonn.; Voy. India Orient., II, p. 171 (1782), (China).

Hackled Partridge.—Lath. Gen. Syn., II, p. 766, pl. 66 (1783), *id.*, Gen. Hist., VIII., p. 307, pl. 129 (Cape ?).

Tetrao ferrugineus.—Gm. S. N., i., pl. 2, p. 761 (1788), China.

Perdix ferruginea.—Lath. Ind. Orn., ii., p. 651 (1790), Africa.

Coturnix spadicea.—Bonnat. Tabl. Encycl. Méth., i, p. 218 (1791), China.

Gallus bankiva.—Temm. Pig. et Gall., ii., p. 87 (1813), Java, iii., p. 654; Steph, in Shaw's Gen. Zoo., XI., p. 198; Horsf., Tr. Linn. Soc., XIII., p. 185; Griff. ed. Cuv., III., p. 20; J. E. Gray, Ill. Ind. Zool. i., 43, fig. 3; Robinson and Kloss, Ibis, 1910, p. 672.

Gallus ferrugineus.—Jerdon, B. Ind. iii., p. 536 (part); Blyth, Ibis, 1867, p. 154 (part); Elliot, Mon. Phas., ii., p. 184, pl. 32, (part); Hume, N. and E., Ind. B., p. 528, part; Kelham, Ibis, 1882, p. I; Nichols, Ibis, 1882, p. 65; *id* Ibis, 1838, p. 255; Oates, *ed* Hume's Nests and Eggs, III., p. 417 (part); Blanf., Avi. Bri, Ind., IV. p. 75 (part); Sharpe, Hand-L.-B., i., p. 39 (part); Bonhote, P.Z.S., 1901, p. 78; Ingram, Nov. Zool., XIX, p. 271; Barton, Journ. N. A. Siam, p. 108; Gairdner and Macolm-Smith, ibid, p. 151; Macdonald, Journ. B. N. H. S., XVII., p. 496 (1906); Baker, ibid, XVII., p. 764 1907); Harington, ibid, XIX, 309 (1909); *Id*, ibid, p. 365 (1909); *Id*, ibid, XX, p. 1010 (1911); Cook, ibid, XXI, p. 625 (1912); Hopwood, ibid, XXI, p. 1214 (1913).

Gallus gallus.—Ogilvie-Grant, Cat. B.B.M., XXII., p. 344 (part); *id* Hand-L, Game B., II., p. 48 (part); Oates, Game B., of In. i., p. 366 (part).

Vernacular Names.—Taukyet (Burmese).

Description—Adult Male.—Differs from the common Indian Jungle-fowl in having the ear lappets red instead of white. The plumage above is generally a deeper red, the neck hackles being less of a golden yellow or orange at their tips. It is also noticeable that the neck hackles are less attenuated and broader at their tips, though the characteristic is very variable, and may in some instances be due to an admixture of domestic blood.

Measurements and colours of soft parts do not differ from those of the Indian bird except for the ear lappets, as already stated.

Adult Female similar to that of *Gallus b. ferrugineus.*

Young Male and Chick in down cannot be distinguished from the same stages in the Common Indian Jungle-fowl until after the first autumn moult, when the deep red of the upper parts at once becomes noticeable. The white ear lappets are replaced by red or deep pink even in very young birds, and will always suffice to show to which sub-species a specimen belongs.

Distribution.—The whole of Burmah and the Malay Peninsula, Siam, Cochin, China, Sumatra and also Java, and many of the Islands of the Malay Islands, as well as in the Great and Little Cocos. In the Cocos the birds are certainly descended from tame stock, and probably in the majority, if not all of the Malay Islands, their origin is the same.

Nidification.—The Burmese Jungle-fowl appears to breed principally in the cold weather, from November to March, but in the hills rather later than this, generally in March and April. Even here, however, it is often a very early breeder, for Harington tells me that he found them breeding in January and February in the Chin Hills, obtaining hard-set eggs in the former month and young chicks in the latter. Mr. C. B. Moggridge found broods of young birds as early as the 10th and 14th of January. In Pegu, Oates found them breeding from the end of February or beginning of March on into June and my collectors took eggs here as late as July, whilst Mr. Barton records finding a bird sitting on six eggs at Raheng in Siam on the 11th March. In the Malay Peninsula they are said to lay during February, March and April, and I have received eggs laid in these months from the vicinity of Taiping.

There is nothing to distinguish either nest or eggs from those of the Indian bird. Oates says:

> "As a rule she makes no nest, but merely scrapes out a "hollow at the foot of a bamboo or other bush; at times there "appear to be a good many leaves under the eggs. These "vary in number from 6 to 9; but Captain Wardlaw-Ramsay "once found 11 eggs in one nest; in colour they are pale buff."

Mr. C. S. Barton, to whom I have already referred, records finding a nest containing 6 eggs in an old stump. This is the only record I can find of the bird building off the ground, though it doubtless sometimes makes its nest in clumps of bamboos just as the Indian Jungle-fowl does.

The usual number of eggs is 5, 6 or 7; often they only lay 4, and on the other hand 8 or 9 may sometimes be found.

In size, shape and texture they differ in no way from those of the Indian bird.

General Habits.—The Burmese Jungle-fowl seems to differ in character from the Indian Jungle-fowl more decidedly than it does in outward appearance, and is probably even more closely allied to the domestic fowl than is the latter bird. It is on the whole less wild, less of a skulker, and far more amenable to restraint and domestication, for several writers record successfully rearing and keeping these fowls together with their barn-door fowls.

A regards choice of country to live in both Indian and Burmese forms seem to have similar likings. Oates writes :

> "There is no description of jungle from which this common "bird is absent; but if it has a predilection for any particular "style of country, it is for the broken ground and ravines with "dense vegetation. In these localities (and there are many "such, especially at the foot of some of the Hill ranges) it is "abundant to a degree. Considerable numbers are generally "found together, the two sexes mixing freely together. In "Burmah, I think, Jungle-fowl are more common near tiny "villages in deep forest than elsewhere, for in the neighbour- "hood of these hamlets there is always a certain amount of "paddy land, a good deal of low cover, and a running stream. "They feed in the mornings and evenings, and during the "middle of the day they remain very quiet, either in some "tree or well-concealed under low bushes or grass."

Mr. C. B. Moggridge (in a letter to the late Col. Harington, which the latter had kindly made over to me with all his own notes) confirms what Oates says, and also emphasises the Jungle-fowl's love of cultivation. "Anyone who has done much Jungle-fowl shooting soon learns to tell at a glance where the birds will fly when put up, but if one does not know the ground one is apt to take the first open space one finds, if it is fairly clear all round for shooting, with disastrous results. The two best places I know are in Gargaw and Madaya, but the former is the better as there are places where both sides of the creek are cultivated for miles, not with paddy, but in gardens. Here the favourite haunts of the birds were in Lu, a species of grain (*Milium paspalum*), Nantsi (Sessamer) and in gardens where a few Zeethe bushes had grown up among the others. All round the villages in Madaya you would find just as many birds as in Gargaw, but between the villages is where the latter gains, the cultivation extending so much further. We always found the beating very easy where there was a creek to stand in or beat over. Jungle-fowl like staying near water, and seem to haunt trees and bushes on the banks of the creeks, not only because of the water itself, but also because they prefer a clear space in which to spread their wings as they fly down from their nests, rather than having to dive down in and out through the closer set trees and bushes. At one place in the district, Gargaw, Mr. P.E. Cleaver got 97 birds to his own gun in one day."

Jungle-fowl are probably more numerous in suitable places throughout Burmah than they are anywhere in India, for the gentleman above quoted in other letters writes :—

> "Bell and I in 1904 in eighteen days shot 360 Jungle-fowl "and in 1905 in thirty days got 435 birds. The number of "days mentioned represents the total number of days we were "out in camp, and on some of these days we did not shoot at all, "being in jungles away from cultivation, etc. All our shooting "was done as we were on the march from one camp to another, "and no day was taken off work and devoted entirely to shooting. Under the same conditions as the above, and being "quite by myself, I shot whilst moving from one camp to "another between the 8th of January and end of February "1910, 316 head of game, of which 127 were Jungle-fowl."

They also seem to collect in larger flocks in Burmah than they normally do in India. In the latter place I have sometimes seen a couple of hundred in the same stretch of cultivation, but they were all broken up into flocks of a dozen or less, and anything over this number was quite exceptional. Davison and Hildebrand on one occasion counted 30 males and females seated on one enormous bent bamboo. This was in Pahporn in Tenasserim where Davison found them extremely abundant. Again near Bhamo Major Whitehead once counted 40 birds together, but these were all cocks without a single hen.

These cock-parties are not unknown in India where young unpaired cocks often seek each other's society and assemble in small flocks of half a dozen or so, but I have never myself come across so large a party as Major Whitehead's, nor have I any similar record from any other observer outside Burmah.

In regard to its food there is nothing special to remark upon, and as an article of diet itself it appears to be much the same as its Indian brothers and sisters.

The crow is said to be distinguishable from that of the Indian Jungle-fowl, and to be more like that of the domestic bird, *i.e.*, with the last note more prolonged and the crow as a whole less short and jerky.

GALLUS SONNERATI.

The Grey Jungle-fowl.

Coq et Poule sauvage des Indes. Sonn. Voy. Ind. Orient, II., p. 148, pls. 94-95 (1782).

Wild cock.—Lath, Gen. Syn., II., p. 698 (1783).

Phasianus gallus.—Scop. (nec Linn.), Del. Flor. et Faun. Insubr. pl. II., p. 93 (1786); Lath, Ind. Orn., II., p. 625 (1790).

Sonnerat's Wild Cock.—Lath., Gen. Hist., VIII., p. 181 (1823).

Gallus sonnerati.—Temm. Pig. et Gall., II., p. 246 (1813); III., p. 659; Steph. in Shaw's Gen. Zool., XI., p. 200, pl. XII.; Temm, Pl. Col. V., pls. 1 and 2; Griffith's ed. Cuv., III., p. 19; Sykes, P. Z. S., 1832, p. 151;

Jard., Nat Lib. Orn., p. 186, pls. XI. and XII.; Blyth, Ann. Mag. N. H. XX., p. 388 ; *id.*, Cat. Mus. As. Soc., p. 243; Burgess, P. Z. S., 1855, p. 29 ; Jordon, B. Ind., III., p. 539 ; Bulger, P. Z. S., 1866, p. 571 ; Blyth, Ibis, 1867, pp. 154, 307 ; Elwes, Ibis, 1870, p. 528 ; Elliot, Mon. Phas., II., p. 34 ; Lloyd, Ibis, 1873, p. 401 ; Hume, N. and E. Ind. B., p. 531 ; Butler, Str. Fr., IV., p. 5 ; Fairb., ibid, IV., p. 262 ; Hume, ibid, IV., p. 404 ; Butler, ibid, V., p. 222 ; Fairb., ibid, V., p. 409 ; Marshall, B. Nests Ind., p. 59 ; Gould, B. Asia, VII., p. 56 ; Hume and Marsh, Game B. Ind., I., p. 231, pl. ; Davidson and Wend, Str. Fr., VII., p. 86 ; Butler, Cat. B. Sind, p. 53 ; McInroy, Str. Fr. VIII., p. 493 ; Vidal, ibid., IX., p. 76 ; Butler, ibid, IX., pp. 205, 421 ; Davidson, Str. Fr. X., p. 316 ; Davison, X., p. 409 ; Swinh. and Barnes, Ibis, 1885, p. 131 ; Taylor, Str. Fr., X., p. 464 ; Terry, ibid, X., p. 479 ; Oates, ed. Hume's Nests and Eggs, III., p. 420 ; *id.* Game B. of In., I., p. 364 ; Blanf., Avi. Brit. Ind., IV., p. 78 ; Sharpe, Hand-L., I.; p. 35 ; Ogilvie-Grant, Cat. B. B. M., XXI., p. 350 ; Barnes, B. N. H. S. Jour., VI., p. 3 ; Davidson, ibid, XII, p. 63 (1898) ; Betham, ibid, p. 363 (1900) ; Ferguson, ibid, XVI., p. 3 (1904) ; Finn., Avi. Mag. Feb., 1910, p. 129.

Phasianus indicus.—Leach, Zool. Misc., II., p. 6, pl. 61 (1815).

Vernacular names.—Jungli-murgha ♂, Jungli-murgi ♀ (*Hindus*); Komri (*Mt. Abu*); Pardah-Komri, (*Gondhi, Chanda Dist.*); Ran-Kombada ♂, Ran-Kombadi ♀ (*Marati*); Kombadi (*Deccan*); Kattu-Kozli or Koli (*Tam.*) ; Adavikode (*Telegu*); Koli, Kad-Koli, (*Canarese*) ; Geera-Kur (*Marie Gond*).

Description—Adult male.—Feathers at the sides of the forehead dull rufous ; head, neck and hackles of the extreme upper back black with grey, fringes to the bases, and with numerous bars changing from golden yellow on nape and shoulders to pure white on the back ; on the longer feathers the black bars are glossed with purple blue. Feathers of the back, rump, and lesser wing coverts black fringed with gray, and with broad white shaft streaks, the majority also with concealed longitudinal grey bars. Longest and lateral rump feathers highly glossed with purple and with chestnut instead of grey fringes, in addition to which they are marked with pale yellow or white spots. Upper tail coverts black glossed with violet, purple and blue, and edged with chestnut and buff.

Median wing coverts and scapulars black, barred on the basal half with grey and with white shafts which expand at the tips for a length of about an inch into spatulate, flat plates of orange yellow about two inch wide ; the majority of which have fringes on the outer side of deep red. Greater coverts and quills blackish brown, the innermost quills and coverts with white shafts, and sometimes a small amount of whitish freckles near the tip. Lower parts from the hackles to vent dark grey brown to black with broad white shaft stripes and grey or grey-white edges ; feathers of posterior flanks and a few of those on the abdomen with orange rufous edges. Feathers of vent and centre of abdomen dull rufescent brown ; under tail coverts black with white edges.

Colours of soft parts.—" The legs and feet are yellow, or reddish yellow, and the claws black, but I have one specimen, probably a young bird, noted as having had the legs and feet greenish brown.

The bill is in the adult, more or less of it, black, the upper mandible often yellowish at the base, and the lower mandible also pale horny, but in younger birds the upper mandible is horny or greenish brown, and the lower mandible yellow. The irides of the adult are yellow or reddish orange, occasionally bright red, in younger birds yellowish brown."—(Hume.)

Finn says that the legs of males in full vigour are a salmon red, and it appears that they are brighter and more red during the breeding season than at other times. The comb, bare face and wattles are crimson, brightest during the breeding season.

Measurements.—" Length 28·0 to 32·0; expanse 27·0 to 31·0; wing 9·35 to 9·65; tail from vent 14·0 to 16·0; tarsus 2·85 to 3·0; bill from gape 1·28 to 1·3; weight 1 lb. 10 ozs. to 2 lb. 8 ozs.; length of spur 1·3 to 1·75 inch."—(Hume.)

The measurements of the birds which have passed through my hands somewhat exceed the above, two cocks having had a wing of full 10 inches (254 mm.) and one or two others nearly approaching it. I have also seen one bird with a tail of 18 inches.

Young male.—Like the female, but much more rufous and more boldly barred and blotched.

Young male on moulting from first plumage and before acquiring hackles has the whole upper plumage black, the feathers grey edged and with white shaft lines; the wings and tails are like the female, but much darker, the underparts are like the adult but without the rufous on the flank and belly feathers. The median coverts and the scapulars where waxy yellow and spatulate in the adult are marked with rufous in the young bird, and a few of the feather shafts are already somewhat flattened and spatulate.

Colours of soft parts.—Legs dull waxy yellow, or horny yellow, never with any reddish tinge; irides brown or yellowish brown; bill horny, the culmen darker and the base of the upper and whole of the lower yellowish horny. The spurs are generally short and blunt, not exceeding 12 mm. in length.

The rudimentary comb and wattles are dull crimson red, but the face is almost as bright a crimson as in the adult.

The adult cock has a semi-moult during the rains, June to August, and loses his long neck hackles, and the long central tail feathers, the former being replaced by short feathers of dull brown black without the terminal sealing-wax spots of yellow.

Adult female.—Upper part of the head dull pale brown, rufescent on the forehead and the feathers faintly white centred; neck golden brown, feathers white shafted and with brown bands on each web which increase in size on the mantle. Whole upper plumage, wing coverts and secondaries finely vermiculated pale sandy brown and dull black; tail dull rufous black mottled with rufous on the central feathers at the edges.

Below white, each feather edged with dark brown and more or less speckled with brown inside this edging; flanks mottled sandy brown and brown with broad white central streaks.

Colours of the soft parts.—Irides red or yellowish red in fully adult birds, yellowish brown in the younger ones and brown in birds of the first year. Legs and feet dull waxy yellow or yellowish brown, according to Hume brownish fleshy in younger birds; the soles are paler and the toes, generally, darker than the tarsus ;. claw dark horny brown or blackish. Bill horny brown, paler at the base of the upper mandible and yellowish white on the whole of the lower. Rudimentary comb and bare facial skin dull crimson or brick red, less dull during the breeding season than at other times.

Measurements.—" Length 18·0 to 20·0; expanse 26·0 to 27·0;
" wing 7·8 to 8·3; tail from vent 6·0 to 7·0; tarsus 2·2 to
" 2·55; bill from gape 1·02 to 1·2; weight 1-lb. 9-ozs. to
" 1-lb. 12-ozs." (Hume).

Chick in down.—Similar to that of the Red Jungle-fowl, but with the lateral bands almost pure white instead of bright pale buff and the sides and lower parts dull grey instead of rich buff and buff respectively.

Hume considers that the northern birds, Mount Abu, " run rather larger and considerably heavier than the Nilgiri ones." I can find nothing to confirm this, and have seen two bigger birds from the south of Travancore than from anywhere else further north.

Distribution.—In 1898 Blanford thus defined the habitat of the Grey Jungle-fowl, and since that date I have seen no record claiming and any further extension.

> " Throughout Southern and Western India in hilly and jungly
> " ground. This Jungle-fowl is found near the Eastern coast
> " as far north as the Godaveri, and in the Central Provinces its
> " limit is some distance East of Sirmcha, Chanda and Seoni.
> " It is found throughout the Nerbudda Valley west of Jubbal-
> " pore, and in parts of Central India and Rajputana, as far as
> " the Aravalis and Mount Abu, but no further to the northward
> " or westward. It is met with near Baroda, but has not been
> " observed in Kattywar. It is common throughout the
> " Western Ghats and Satpuras, and it is found, though not
> " abundantly, on the tops of the Nilgiri and Palni Hills."

Southwards it is found almost, but not quite, down to the extreme south of Travancore.

Nidification.—The breeding season, properly speaking, extends over February, March, April and May over the greater part of this bird's habitat, though Davison writing of the Western Nilgiris records October, November and December as the principal breeding months. As a matter of fact eggs, fresh and hard-set, and young, just hatched or nearly fully fledged, may be found in practically every month of the year. The months in which most will be found are those in which food is most abundant, a matter dependant upon the rains and other climate influences. In Travancore they breed steadily from March to July, and Mr. T. F. Bourdillon took eggs as late as August 20th. They make their nests—when they make any—and lay their eggs in much the same kind of country and jungle as do the Red Jungle-fowl, and, like the latter birds, seem to specially approve of dense secondary growth and bamboo jungle. They breed freely in the Sholas, or small woods, which nestle in the hollows in the Nilgiri Hills, but they also breed in just as great numbers in the vast woods of Travancore and Mysore. Often they lay their eggs in a small hollow, either natural or scratched out by themselves in the shade of some bush or bamboo clump, and the nest consists merely of a slight collection of rubbish and fallen leaves. Sometimes the nest is formed of a mound of such material with a hollow in the centre for the eggs; more rarely it is comparatively well made of sticks, leaves, bamboo-spates, matted together in a solid mass whilst in still more cases it is perched up on a dead tree or stump or a clump of bamboos.

The number of eggs laid is rather a vexed question. Miss Cockburn, who was always extraordinarily lucky in the number of eggs laid by birds with which she came in contact, says that the number of eggs found in a nest is from 7 to 13; Jerdon says from 7 to 10, and Davison says from 6 to 10. On the other hand Mr. J. Davidson tells me that he has never found more than 4 eggs in a nest, and Barnes mentions the number as 6 or 7, occasionally more. Mr. J. Stewart, through whose hands have passed a very large number of Travancore clutches, and who has seen an immense number *in situ* in a letter to me says, " I am sending you a clutch of 7 eggs of the Grey Jungle-fowl, an unusual number, for they generally lay only 4 or 5, and sometimes even less." There is a general tendency to overestimate the number of eggs laid by game-birds, and from the testimony of modern collectors I think it will be found that 4 or 5 eggs is the number most often laid, and that whilst a fair number of clutches of 6 or 7 eggs may be found, more than this is quite abnormal.

The eggs are of course very small, but can be otherwise all matched by varieties of the domestic fowl's eggs. The most common type is fawn, or fawn-buff, but they vary from very pale cream to a rich warm buff, generally quite immaculate, but sometimes covered with innumerable freckles of light brown, and occasionally distinctly spotted and speckled with light brown, dark brown, or reddish brown. In the latter case the spots are generally sparsely and irregularly scattered over the whole surface of the egg and vary in size from that of a pin's head to spots as much as a couple of millimetres or more in diameter. These spotted and freckled eggs are, however, exceptional, though comparatively a good deal more often met with than they are in *Gallus bankiva ferrugineus*.

As a rule the surface is very fine, smooth and glossy, but they vary from this to a surface which is densely pitted with tiny pores like those found on a guinea-fowl's egg. In shapes they are typical fowl's eggs, but in a large series a fairly wide divergence of shape may be met with, from a long narrow oval almost the same at either end to a broad squat oval with the smaller and distinctly pointed and compressed.

In length the 50 eggs I have measured myself or of which I have had measurements sent me varied between 1·72″ (43·7 mm.) and 2·12″ (53·9 mm.) in length and between 1·30″ (35·0 mm.) and 1·46 (37·1 mm.) in width. The average of the 50 eggs is 1·80″ (45·7 mm.) by 1·40″ (35·5 mm.).

Oates gives the variation in breadth of the series in the British Museum as being far greater than given above, but I have most carefully measured the series and find them all to come within these limits.

General habits.—Since Davison wrote his splendid description of this bird's habits there has been practically nothing further of value recorded, and so exhaustive and interesting are these notes, that it is not likely that there will ever be much to add.

He writes:

> " The Grey Jungle-fowl occurs but sparingly about the " higher portions of the Nilgiris, but is common on the lower " slopes, in the low country about the basis of the hills, and " throughout most parts of the Wynaad. I have found it " most abundant in the jungles between Metapolliem and " Kullar, and between this place and Burliar about half-way " between Kullar and Coonoor, I counted 26 once (while " riding up to Coonoor early one morning) feeding along the " cart road here.
>
> " Unlike the Red Jungle-fowl, this species is not gregarious, and though occasionally one meets with small coveys, " these always consist of only one or two adults, the rest " being more or less immature. As a rule, they are met with " singly or in pairs.
>
> " The crow of the male is very peculiar, and might be " syllabled, *kuck-kaya-kya-kuck*, ending with a low, double syllable like '*kyukun, kyukun*,' repeated slowly, and very softly, " so that it cannot be heard except when one is very close to the " bird. Only the males crow, and that normally only in the mornings and evenings, though occasionally they crow at intervals " during the day when the weather is cloudy. The crow is " very easily imitated, and with a little practice the wild " birds may be readily induced to answer.

" They do not, however, crow the whole year through, but " only from October to May, when they are in full plumage.

" When flushed by a dog in the jungle, they flutter up into " some tree above with a peculiar cackle, a '*Kuck-kuck-kuck*,' " which, however, they only continue till they alight.

" They come into the open in the mornings and evenings, " retiring to cover during the heat of the day, unless the " weather is cloudy, when they may be met with in the open " throughout the day.

" Though found in evergreen forests, they seem to prefer " moderately thin and bamboo jungle.

" Ordinarily, as already remarked, they are found scattered; " but when a tract of bamboo comes into seed, or any other " particular food is locally abundant, they collect there in vast " numbers, dispersing again as soon as the food is consumed. " I remember on one occasion when the undergrowth of the " *Sholas* about Pykarra (which consists almost entirely of " *Strobilanthes sp.*) seeded, the Jungle-fowl congregated there " in the *greatest* numbers. I mean by hundreds, and were " excessively numerous for more than a fortnight, when they " gradually dispersed, owing, I believe, not so much to the " seeds having all been eaten, as to what remained of them " having sprouted and so become uneatable.

" In some ways they are not very shy; by taking an early " stroll, even without a dog, along some quiet road by which " cattle and grain pass, several can always be obtained, but " when they have been at all disturbed and shot at, they " become very wary, and even with a dog, before which they " ordinarily perch at once, they are very difficult to secure. In " such cases they run till they think they are out of shot, and " then rise, and instead of perching, take a long flight, often " of many hundred yards, and when they do alight, commence " running again.

" When out feeding they do not usually wander far from " cover, and on any indication of danger they dart back into " this. They do not, however, go far in, generally only for a " very short distance, before stopping to listen, when, if all " seems quiet, they reappear in a short time within a few " yards of the spot at which they entered. If, on the contrary, " after listening they think that there is still danger, they " then retreat quietly and silently into the depths of the " jungle; occasionally, after they have got some distance " flying up and hiding themselves in some bushy tree.

" When, however, as sometimes, though rarely happens, " they are surprised some distance out in the open, they " do not run but rise at once and fly for the nearest cover,

" either perching in some leafy tree, or else dropping to the " ground.

" They are very punctual in their appearance at particular " feeding grounds, and when one or more are met with in any " particular spot, they are certain, if not disturbed in the " interim, to be found there again in the same place at about " the same hour the next or any subsequent day on which they " may be looked for. There was one particularly fine and " remarkably shy and cunning old cock that frequented an " open glade in the forest (above the Government Cinchona " Plantations at Neddivuttum) in the *morning*, whereas in the " *evening* he always came into the plantation and wandered " about under the cinchona trees, and along the plantation " roads. He never, to my knowledge—and I must have seen " him fifty times at least—came into the plantation in the " morning, or into the glade in the evening. There was no " doubt as to this being the same bird that frequented the two " places (nearly a quarter of a mile distant), for he was the " largest, handsomest, and to judge from his spurs, the oldest " cock I ever saw. 'I loved that cock as a brother, I did, and " *at last* I circumvented and shot him.'

" The best time to shoot the Jungle-cock is from October " to the end of May, as then his hackles are in the best " condition.

" In June the moult begins, and the male gradually drops " his hackles and long tail feathers, the hackles being replaced " by short feathers, as in the female; during the rains the male " is a poor mean-looking object, not in the least like his " handsome self in the cold weather, and, fully conscious of " this fact, he religiously holds his tongue during this period.

" In September, a second moult takes place, the short " feathers of the neck are again replaced by the hackles, the " long tail feathers reappear, and by October the moult is " complete and our Southern Chanticleer as noisy as ever.

" The male usually carries its tail low, and when running, " it does so with the tail lowered still more, the neck out- " stretched, and the whole body in a crouching position as in " the Pheasants.

" I do not know for certain whether the species is polygam- " ous or monogamous, but from what I have observed I should " think the latter; for although the male does not, I believe, " assist in incubation, yet when the chicks are hatched, he is " often to be found in company with his mate and little ones.

" These birds are, I believe, quite untamable, even when " reared from the egg, and though in the latter case they may " not be so wild as those captured in maturity, they never take "kindly to domestic life, and avail themselves of the first "opportunity for escaping. It is needless to say that they "cannot easily be induced to breed in captivity. I have "known the experiment tried time after time unsuccessfully.

"Numbers are trapped by the professional fowlers of Southern India and brought for sale, together with *Pavo cristatus*, "and *Perdicula asiatica* to the stations on the Nilgiris, where "cocks in good plumage may be purchased for about 8 annas "each. Numbers are also brought to Madras from the Red "Hills, where they are even cheaper. When caught, the eyes "are closed by a thread passed through the upper and under "eyelids and then knotted together; a short string is then tied "to one leg, and the other end made fast to a long stick. A "number of birds are placed side by side on this stick, which is "then carried about on a man's head. The poor blind birds "remain quiet, not attempting to flutter or escape.

"Except for his feathers or as a specimen, the Grey Jungle-"cock is hardly worth shooting; the breast alone is really "eatable, and even at the best the breast is very dry and "hard.

"They roost on trees, continually in the early mornings, "just at daylight, when out shooting Sambhur, I have disturbed them from the trees on which they had spent the night.

"Although armed with most formidable spurs, they are not, "so far as my experience goes, quarrelsome or pugnacious. "In the wild state I have never seen them fighting, and I for "many years enjoyed peculiar opportunities for observing "them. In captivity half a dozen, with as many females, "will live in the same compartment of an aviary in perfect "peace.

"Another proof of their non-belligerent character is to be "found in the fact that the native bird-catchers never peg "males out to attract others, as they do in every part of the "East with all birds that are naturally pugilistic. Scores of "times I have listened to two cocks crowing at each other "vigorously from closely adjoining patches of cover, but "neither apparently ever thinking of, as an American would "say, *going* for that other cock.

"They are, I think, altogether less plucky birds than the "Red Jungle-fowl, and they are so extremely wary, where "birds and animals of prey are concerned, and wander such "short distances from the edges of cover, that I think very "few of them fall victims to any enemy but man. There are "plenty of Bonelli's Eagle and some Hawk-Eagles too in "the Nilgiris, but I do not think that these ever succeed in "capturing Grey, as they do elsewhere Red, Jungle-fowl; at

" any rate, I have never once seen the feathers of *sonnerati* " strewed about, as I have those of *ferrugineus* in Burma.

" Their great timidity and watchfulness result in their " yielding much less sport than the Red Jungle-fowl. You " may get these latter in standing crops and in many other " similar situations without any extraordinary precautions, but " the Grey Jungle-fowl never goes more than a few yards inside " the fields, and if a stick cracks, or a sound is heard anywhere " within 50 yards, he vanishes into the jungle, whence it is " impossible to flush him. Only when beating the narrow " well defined belts of tree jungle that run down the ravines " on the hill sides in the Nilgiris, and which we there call " '*sholas*,' is anything like real spot to be got out of them. " Then indeed the gun at the tail end of the shola *may* get " three or four good shots in succession, as they rise at the " end of the cover and fly off with a strong well-sustained " flight to the next nearest patch. Even thus, working hard " and beating shola after shola, a man will be lucky to bag 5 " or 6 brace in a day.

" The reason is, that all the well-defined sholas which can " be thoroughly beaten are in the higher parts of the hills, " where the birds are comparatively rare, while, when you get " lower down, where the birds are plentiful, the jungles are so " large that they cannot be effectively worked. If you merely " want to *kill* the birds, you might get perhaps 10 or a dozen " in a short time poking along some of the roads, but they " afford no sport thus, only a series of pot shots.

" I remember once watching an old cock that my dogs had " driven up into a tree. For some time I peered round and " round (the tree was a large and densely-foliaged one) " without being able to discover his whereabouts, he all the " while sitting silent and motionless. At last my eyes fell " upon him, that instant he hopped silently on to another " bough, and from that to another, and so on with incredible " rapidity, till, reaching the opposite side of the tree, he flew " out silently, of course never giving me a chance at a shot.

" As for food, they seem to eat almost anything; grain, " grass seed, grubs, small fruits and berries, and insects of " different kinds. I have sometimes killed them with " nothing but millet in their crops; at other times quantities " of grass seeds, or again, after the grass has been recently " burnt, the tender, juicy shoots of the new grass."

GALLUS LAFAYETTI.

Gallus lafayetti.—Less. Traité d'Orn., p. 491 (1831); Des Murs. Icon. Orn. pl. 18; Elliot Mon. Phas. ii., p. 33 (1873); Hume X. and E. Md. B. p. 530 (1875); Hume and Marshall, Game B. Ind. i., p. 241, pl.; Hume, Str. Feath. VII., p. 429; Legge, B. Ceyl. III., p. 736, pl.; Oates ed Hume's Nests and Eggs, iii, p. 422; Ogilvie-Grant. Cat. B. B. M. XXII., p. 349 (1893); *id.* Hand-L. of Game B. II., p. 53 (1897); A. L. Butler, Jour. B. N. H. S. x., p. 311 (1896); Lewis, Ibis 1898, p. 339, 550; Blanf. Avi. Brit. Ind. IV., p. 77; Sharp, Hand-L. i., p. 39.

Gallus stanleyi.—Gray, Ill., In. Orn. III., pl. 43 (1833); Blyth, Cat. B. A. S. B., p. 243 (1849); Jerdon B. of I. III., p. 540 (1860).

Gallus lineatus.—Blyth, J. A. S. B. XVI., p. 387 (1847).

Vernacular names.—Weli-kukula ♂, Weli-kikili ♀ (*Cing.*); Kada Koli (*Tam.*)

Description, adult male.—Crown dull orange rufous; feathers at the base of the naked throat in a patch about an inch long rich violet purple; hackles on neck and upper back orange yellow shading into this from the rufous of the head and again into fiery orange red on the back; the yellow feathers have black central streaks and the red feathers rich maroon ones, the black and the maroon marks grading into one another just as the rest of the colours do. Lower back and rump still darker, almost copper, red, the centres to the feathers here being deep violet blue, whilst the central and least lanceolate feathers have also a broad terminal patch of this colour; a few of the longest upper tail coverts all black glossed with blue except for a narrow edge of fiery red. Tail black glossed with Prussian blue or blue-green, never apparently glossed with copper as in *G. b. ferrugineus*. Lesser wing coverts like the hackles of the neck, gradually merging into the median coverts which are like the back; greater coverts black on the visible portions, deep rufous red or mottled rufous and black on the concealed portions. Breast and flanks like the back, the non-lanceolate feathers next the abdomen rufous chestnut with broad black terminal bands; vent and centre of abdomen dull brown-black with paler tips. Thighs black, most of the feathers with narrow chestnut fringes; under tail coverts glossy blue-black.

Colour of soft parts.—"Iris light golden yellow; face, throat and wattles livid or purplish red; comb bright red with a large interior yellow patch, brightest in front and blending into the surrounding colour; bill brownish red, the lower mandible and tip of the upper pale; legs and feet wax yellow, washed anteriorly with brownish, more especially on the toes." (Legge).

Measurements.—"Length of examples with fine tails (which vary in length) 26·0 to 28·0 inches; wing 9·2 to 9·5; tail 13·0 to 15·0; tarsus 3·2 to 3·4; middle toe 1·7 to 1·8; claw (straight) 0·5 to 0·6; bill to gape 1·2. Length of comb from forehead to extremity 3·2 to 3·3 inches; spur 0·7 to 1·2." (Legge).

"In the birds I have been able to measure the wings vary between 8·5″ (215·9 mm.) and 9·5″ (241·3 mm.) and the longest tail was 16″ (406 mm.) whilst others were as short as 9″ or 10″ (228·6 to 254·0 mm.) "Weight 2-lbs. to 2-lbs. 5-ozs." (Hume).

Young males when they first acquire adult plumage appear to have the centre of the belly and vent more rufous, the black bases to the feathers hardly showing.

Younger birds still first acquire a certain number of semi-lanceolate feathers intermediate in colouration between the adult and the first plumage; the upper parts from the back to the tip of the tail are dark rufous, vermiculated with black, some of the back feathers showing small violet blue patches. Below the breast is a deep rufous chestnut, slightly barred and vermiculated with black on the upper breast and profusely so on the lower breast where it changes into the dull dirty grey-black abdomen, lower flanks and vent. The under tail coverts are mixed rufous and black.

"*Young males in first plumage.*—In the bird of the year the iris is light yellowish, the bill much the same as in the chick; the comb and spurs but very little more developed and the wattles are absent. The head and upper part of the hind neck are yellowish rufous, the feathers with darker centres, deepening into chestnut red on the inter-scapular region, sides of neck, and breast; in the lower part of the hind neck the feathers are somewhat elongated, with glossy blackish centres, and there are signs of the dark foreneck patch; the metallic purple of the adult rump is present in small patches on the feathers; the ground colour and tail, which is short, is ferruginous, mottled with blackish, with a greenish black wash on some of the tail feathers; wings blackish brown, the secondaries and their coverts handsomely mottled with rufous and buff; chin and gorge whitish, the feathers very short, lower parts rufescent, tipped with rufous." (Legge).

Adult female.—Forehead dull rufous red, crown dull brown, the feathers finely tipped black, nape, sides of the neck and sparse feathers of the throat dull rufous. Mantle, of which the feathers are far less lanceolate than in *b. ferrugineus*, blackish brown with pale shaft streaks and golden buff edges. Remainder of upper plumage pale buff, rufous buff or rufous brown vermiculated all over with black in fine wavy bars; on the tail the vermiculations are bolder becoming irregular longitudinal barrings and blotches of black glossed with green. Median and smaller coverts like the back, but with sub-terminal bars of black and often white shafted; the greater coverts and edge of wing are boldly barred with black and pale yellow buff; primaries pale brown, mottled on the outer webs with black and buff; outer secondaries brown, boldly barred with black and buff on the outer webs, inner secondaries vermiculated brown and buff along the centre, and boldly barred with black and buff on both webs and with chestnut vermiculations showing here and there.

Below the almost semi-nude throat and foreneck a few feathers with broad glossy black edges take the place of the black patch in the male; upper breast, sides of the lower breast, and flanks vermiculated black and rufous brown, remainder of breast, belly and thigh coverts white, each feather with a narrow black edging and one or two broad black bands near the visible base. Vent dull pale buff, under tail coverts black and rufous brown, much marked with white in some individuals.

In some females which appear to be much younger birds the rufous brown of the upper breast extends lower down, the brown of the flanks extends on to the breast, and only the centre of this latter is black and white, a few red vermiculated feathers appearing amongst the others. In these birds it is also noticeable that there are no white shaft streaks to the upper plumage, and the general tone is more rufous and less earth-brown. The throat is, of course, comparatively well feathered with downy grey plumes.

Colours of soft parts.—"Iris yellowish olive; bill, upper mandible dark brown, lower yellowish; tarsi and feet brownish in front, yellowish posteriorly." (Legge).

Measurements.—"Length about 13·75″; wing 6·8 to 7·0; tail 3·5; tarsus 2·3 to 2·5; middle toe and claw 2·0 to 2·1; bill to gape 1·1." (Legge).

Wings of the females in the British Museum series and of a few others I have measured have varied between 6·5″ (165·1 mm.) and 7·2″ (183·8 mm.)

Distribution.—Confined to the Island of Ceylon in which Legge describes its distribution as follows:—

> "More or less scattered through the dry jungly districts of "the low country, and diffused throughout the hills of the "Southern and Central Provinces. It is rather rare in the "jungles of the maritime portions of the Western Province "and south-western district, and is not common even in the "forests of the interior . . . . On the eastern slopes of the "Morawah Korale where a drier climate prevails it finds a more "congenial home, and along the Wellaway River and from that "eastward it is numerous. In the maritime portions of the "south-east it abounds . . . . In the hills it is resident and "breeds commonly up to 6,000 feet."

It is perhaps to some extent locally migratory, ranging higher or lower on the hills according to season, but beyond this appears to be resident wherever found.

Nidification.—It is almost impossible to say that the Ceylon Jungle-fowl has any real breeding season, for throughout its range it would appear to be breeding during practically the whole year.

Legge records that in the north of the Island it breeds principally during the early part of the year, but that in the Hambantota district he found young birds in July, others in the neighbourhood of Kadugannawa in December and others again in the Horton

Plains in April, whilst he took eggs in Kukal Korale in August. Again writing to Hume he notes having seen young birds with their parents in the South of the Island as early as February.

Mr. W. E. Wait of the Ceylon Civil Service informs me that "the birds breed more or less throughout the year, and I have eggs taken in the months of February, April, June and August," whilst I have seen others taken in some of the months already mentioned and also January, May and November.

As a rule the Ceylon Jungle-fowl makes its nest of a pile of leaves and fallen rubbish in some natural hollow in forest. In his "Birds of Ceylon" Legge writes:—

> "The nest is almost always placed on the ground near a "tree, under a bush, or beneath the shelter of a fallen log; a "hollow is scratched and a few dry leaves placed in it for the "eggs to repose upon. I once found a nest in damp soil "between the large projecting flange-like roots of the Doon-"tree, containing two eggs partially incubated.
>
> "In 1873 Mr. Parker found a nest on the top of a young "tree about 30 feet high. He writes me that it had the 'appearance of a Crow's or Hawk's nest, of which the Jungle-"hen had taken possession. She flew off and three eggs were "found to be in the nest."

This curious habit of making its nest at some considerable height from the ground seems to be rather a characteristic of this Jungle-fowl. Many years ago I was told that such was the case by Mr. W. A. T. Kellow and by a Mr. W. Jenkins who collected for me in Ceylon and recently Mr. W. E. Wait again refers to this trait. He says:—

> "In one respect I differ from Legge's account of the nest-"ing of the Ceylon Jungle-fowl, or perhaps I should say "supplement what he says, for I would add that this bird's "nest is quite as often built off the ground as on it. The "most peculiar situation I have come across was in an oven-"shaped hollow about 8 feet from the ground in a fairly large "tree which stood at the edge of a cart track running "through the jungle. A big branch had been torn off at its "junction with the stem of the tree and the socket had rotted "out. In the hollow thus formed four eggs had been laid on "a soft layer of touch-wood which had crumbled to dust. On "another occasion I came across a nest in a bush overhanging "a dry water course. It was a mere depression in a matted "platform of dead leaves which had been swept down the "water course in some flood, and had been caught up by the "overhanging branches.
>
> "A favourite site is a stump of a tree which has been "felled and left standing after the tree has been taken away.

' In these cases there is a scanty bed of dead leaves which have
" fallen from the surrounding trees and collected in the hollow
" which generally forms on the upper surface of the stump in
" a very short time."

Other naturalists who refer to this habit of building in the stumps of old trees are Layard, Parker and Hart, so that it seems to be one well known both to the natives of Ceylon as well as to European observers.

The Ceylon Jungle-fowl lays but very few eggs and we may dismiss Layarde's statement that they lay from 6 to 12 eggs without further consideration. The normal clutch would seem to be 2, 3 being sometimes laid and very rarely 4.

Legge says :—

" I have generally found that the eggs do not exceed 2 in
" number, but sometimes 3, and occasionally 4 are laid."

And Mr. Wait writes me that his own experience agrees with that of Legge and that whilst he has but one clutch each of 4 and 3 eggs, he has taken many of 2, the majority of which have shown signs of incubation, slight or advanced.

The eggs when seen in a series at once strike one as differing from all other Jungle-fowl's eggs, in that the *majority* are more or less spotted and speckled, whilst some are quite heavily marked in this way.

I have now seen a considerable number of the eggs of the Ceylon Jungle-fowl ; 9 in the British Museum series, a fine series collected by Mr. Wait, and a few others collected by Jenkins, Kellow and others and some in the Ceylon Museum.

In colour they are a pale stone, pale yellow buff or cream, in one or two slightly darker, but in none that I have seen do they ever approach the rich buff tint often seen in the eggs of the other species of Jungle-fowl. A few eggs are practically unmarked, but 3 out of 4 differ from those of the Red and Grey Jungle-fowl in being distinctly and profusely spotted with light brown or light purple brown. In some eggs the markings consist entirely of the finest freckles scattered over the whole surface of the egg in such numbers that at a short distance and casually examined the egg looks almost unicoloured ; in the majority of eggs, however, the tiny specks are accompanied by small blotches and larger freckles giving them a distinctly spotted appearance, whilst in others the shell is boldly blotched and marked with light brown, a few of the larger blotches measuring as much as 3 to 4 millimetres in diameter.

One egg in Mr. Wait's collection has a pinkish stone coloured ground with numerous very fine freckles of dark red brown and a few small but bold spots and blotches of dark brown.

The eggs in a clutch are not as a rule very evenly coloured, one being generally more spotted than the others, and sometimes the contrast between the different eggs in the same clutch is very striking.

The texture of the eggs is similar to that of the domestic fowl's egg, and varies to about the same extent. In some it is quite smooth and highly glossed, in others, just as hard and glossy, the whole surface appears to be minutely pitted with tiny pores, and in nearly every such case the pores contain the dark colouring pigment which gives the freckled appearance.

In shape they are remarkably constant, being broad short ovals, the smaller end differing but little from the larger. I have two eggs which are exceptionally long and narrow, and have seen one other which had the smaller end somewhat compressed.

They vary in length between 1·65″ (41·9mm.) and 1·95″ (49·5 mm.) and in breadth between 1·27″ (32·2mm.) and 1·57″ (39·8 mm.), whilst the average of 28 eggs is 1·82″ (46·2mm.) × 1·39″ (35·3mm.)

The cock is apparently polygamous, though there is no very decided proof one way or the other. At all events, no one has yet discovered him taking an interest in his chicks, a trait which has been observed in the Grey Jungle-cock.

The affection between hen and her chicks and *vice versa* has, however, been more than once commented on, and Legge notes how he once shot a hen whose half-grown chicks ran backwards and forwards about her where she fell until he had come up quite to them. The young would seem to remain with the hen until the succeeding breeding season, although the cock birds again mingle with the hens as soon as their duties of rearing their young are completed.

General habits.—On the whole the Ceylon Jungle-fowl appears to be a bird of the drier parts of the Island, being excessively common in the maritime portion of the south-east coast in the dense Euphorbia Jungles which are there found in long stretches. It is probably resident wherever found, but it possibly only wanders into the highest hills during certain seasons of the year. Legge observes :—

> "It is resident and breeds commonly up to about 5,000 feet. " On the Nuvara-Eliya Plateau and up on the Horton Plains " it is very abundant during the north-east monsoon, coming " up from lower down on the hills, and probably to some " extent from the low country, to feed on the berries of the " nilloo. It is probable that many remain throughout the " year in these uplands ; but, as I have only visited the Horton " Plains during the cool season I am unable to say if it is " found in that locality to any extent during the wet season."

The Ceylon Jungle-fowl seems to be found in all sorts of jungle, from the magnificent tree forest which covers the sides of the hills and mountains to the low Euphorbia and other scrub jungle found on the sea coast and elsewhere. It is equally common in the bamboo-covered country, and may be found in bush, semi-cultivation, or the dense secondary growth surrounding villages and old cultivation.

They are extremely quarrelsome, pugnacious birds; quite as fond of fighting as the Red Jungle-fowl and far more prone to this diversion than the grey birds. Layard says:—

> " The cocks fight most desperately in defence of their serag-
> " lios, the combat frequently terminating in the death of one
> " of the engaged parties."

Their pugilistic tendencies often bring them to grief in other ways, however, for the natives are aware of them and, *vide* Legge, make use of them to decoy them within shot.

> " The sound of the flapping of the wings, which is of course
> " the invitation to battle, has the effect of always drawing two
> " birds together and the knowledge of this fact has given rise to
> " the device of imitating the noise, by doing which the sports-
> " man can bring the cock up to him, and if he be properly con-
> " cealed can easily shoot him. The natives make this sound by
> " clapping against their thighs with the palm of the hand
> " hollowed, but Europeans can best do it by making a pad
> " with the handkerchief and beating it against the palm of the
> " other hand. By this means the exact sound can be made
> " and I myself once procured a very fine specimen in the
> " Ostenburgh Woods by adopting this plan."

I have never heard anyone speak of making a regular business of shooting the Jungle-fowl in Ceylon as sportsmen do with the Grey Jungle-fowl in the Nilgiris and with the Red Jungle-fowl in many districts.

Legge remarks that:—

> " This handsome bird, although so very abundant in many
> " parts is by no means easy to shoot. It dwells entirely in
> " cover, and though it is so fond of frequenting the vicinity of
> " paths and tracks through forest, its sense of hearing is so
> " acute that it removes to a safe distance at the sound of appro-
> " aching footsteps, and though it will continue to utter its
> " challenge cry of "George Joyce", it gradually makes its
> " way off behind some protecting hillocks or rise in the
> " ground which shuts out the road or path from its view. The
> " north-eastern forests are well suited to its habits, the ground
> " being covered with dry leaves, which do not decay so soon
> " as in the humid jungles of the south; and among these,
> " harbouring a multitude of seeds, insects, and grubs, it
> " scratches exactly after the manner of its domestic race. This
> " scratching may often be heard on a still morning at some

" distance away, and if the bird be behind a mound or little
" eminence it can be approached if the sportsman is cautious
" and makes no noise."

Mr. W. E. Wait of the Ceylon Civil Service who has been so good as to send me some very interesting notes on Ceylon game birds, says that he thinks the words " Chuck joy joyce " describes the cry of the Ceylon jungle-fowl even better than does the usually accepted syllables " george joyce." He adds :—

" The cocks often crow in the morning before coming down
" from the branches on which they roost as I have several
" times found when stalking a crowing bird. I have general-
" ly found them on a branch some 8 to 12 feet from the
" ground, never very high up, although Legge says that they
" roost on good-sized branches at a considerable height from
" the ground.

" Both cocks and hens feed along the grassy strips by jungle
" roads and paths in the mornings and evenings, especially if
" the ground is damp after rain. They do not, however, stay
" out very late, and by about 9-0 a. m. they have all entered
" into the jungle again, and the cocks have stopped crowing.
" Sometimes, however, if the weather is cloudy or wet and cool
" they will stay out feeding all day long, even when it is
" actually raining. I remember once bicycling over a main
" road through a forest in the North-Western Province on such
" a day and within a distance of a mile or less I saw over a
" dozen birds, mostly cocks.

" Hens with chicks keep more closely to cover than do the
" cocks, leading their broods about in the undergrowth,
" uttering a little squeaky metallic chuck as they go, ap-
" parently a call note to the little ones. The broods remain
" together until the chicks are almost full-grown, but I have
" never seen cocks accompanying hens with chickens. The
" cocks are polygamous, and I have frequently seen one feed-
" ing with two or three full-grown hens, but he sheers off as
" soon as family duties commence."

It is a very common idea amongst the natives of Ceylon that when the Jungle-fowl eat the seed of the " nilloo", a species of *Strobilanthes* which grows from 5,000 feet upwards, they become either blind or drunk, in which condition they are rendered so devoid of all sense or are so incapable that they are often caught. It is rather difficult to say whether there are grounds for this belief or not. Bligh wrote to Legge in connection with this belief:—

" About that season of the year if village fowls be brought
" to the hills they rarely escape a serious eye disease, which
" rapidly spreads throughout a given district, and in many
" cases they become totally blind in two or three weeks. This

> " is the disease which the Jungle-fowl evidently catch. A
> " dog of mine caught a Jungle-cock with one eye lost, and
> " evidently from this cause."

A collector working for me in Ceylon also once wrote to me that he had caught a cock sitting crouched under a bush, which made no attempt to fly as he approached, and which, when released, tumbled about for a bit on the ground, and then huddled itself up in some grass and allowed itself to be again caught. Nothing was observed to be wrong with this bird physically, but its actions gave it the appearance of being hopelessly intoxicated.

Mr. W. A. T. Kellow also once wrote to me and said that his collector informed him that it was no rare thing for them to catch Jungle-fowl in this—as they termed it—intoxicated condition. It may, however, be that Bligh's explanation is the correct interpretation of these curious cases of apparent intoxication. That there is something which occurs at the time the *Strobilanthes* seeds, which renders the Jungle-fowl practically helpless is vouched for by Legge himself who asserts:—

> " Certain it is that at this period the Jungle-fowl in the
> " Horton Plains and about Nuvara-Eliya do become affected,
> " and are apparently so intoxicated that they may be knocked
> " down with a stick."

The crow of the Ceylon Jungle-cock has been described, as I have said above, as a call of "George Joyce" rapidly repeated. This call, according to Mr. Holdsworth, is uttered by the cock as he runs up and down some stout branch, raising and lowering his head at each call. Never having seen the bird in its wild state, I cannot say whether this is correct or not, but when in captivity it undoubtedly "crows" much as a domestic cock does, stretching himself on tip-toes higher and higher as he proceeds, and often flapping his wings both before and after crowing. I have often seen the Red Jungle-fowl crow, and certainly this is the attitude always adopted by them, and it is most amusing to see a fine Jungle-cock caught in the middle of a crow; his triumphant attitude of challenge to the whole world crumples up so instantaneously as he leaps to the ground and skulks off with head and tail down and body as close to the ground as he can get it.

The Ceylon Jungle-fowl is not easy to bring up in captivity, and as a rule does not long survive close confinement. At the same time a good many birds have been successfully reared and domesticated, though I know of no instance in which birds allowed their freedom have not eventually cleared off altogether.

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XV.

(*A*) The Indian Gerbils or Antelope Rats.

By R. C. Wroughton.

The group of animals represented by the name *Gerbillus indicus*, in Blanford's Mammalia (No. 264), was recognised as a sub-genus of *Gerbillus*, by Lataste, in 1882 (Le Naturaliste, ii. No. 16, p. 126) under the name *Tatera*. In 1902 it was accepted as a full Genus, whose members were found from Cape Town, northwards throughout Africa, and thence eastwards through Persia and India to Ceylon. The type species of the genus was "*Gerbillus indicus*, Hardwicke."

The tail in all the African species (except in *nigricauda*, from British East Africa, which has a wholly black tail) is dark above and pale below, whereas in all the Asiatic forms the tail is dark above and below, and pale on the sides. Mr. W. R. Sherrin has recently called my attention to a skull character, *viz.*, the shape of the parietal bone, which on examination proves to be quite as constant a distinguishing character as the tail pattern. I now therefore have no hesitation in separating the African forms as a distinct Genus, which I propose to call.

Taterona, gen. nov.

Genotype *Taterona afra* (*Gerbillus afer*, Gray.)

The tail is dark above and pale below (except in *nigricauda*, where it is entirely black), whereas in restricted *Tatera*, it is dark above and below and pale at the sides.

The lateral sutures of the parietal, from the post-orbital process backwards, run horizontally for a certain distance, then turn vertically downwards for a greater or less distance; and again return sharply to the horizontal. In *Taterona* the length of the middle vertical part of the suture varies a little, but never exceeds one-third of the distance between the post-orbital process and the downward turn, while in *Tatera it* is approximately equal to this distance.

In *Taterona* the basi-sphenoid appears to taper forward to a point or narrow neck, owing apparently to the turning upwards of the lateral edges, almost to the vertical ; in *Tatera*, in which these edges are less turned upwards the basi-sphenoid does not seem to taper.

Finally in *Taterona* the bridge over the ante-orbital foramen is relatively wider than in *Tatera* and the plate below the lachrymal formed by the flattening of the front edge of the orbit terminates more abruptly at its outer end in *Taterona* than in *Tatera*, in which latter it is also usually broader. These last two characters however, though true in a very large number of cases, are not constantly reliable.

The Geographical ranges of *Tatera* and *Taterona* correspond with the continents of Asia and Africa respectively.

When I studied these Gerbils some years ago (A.M.N.H. 7, Vol. XVII, p. 474, 1906), the material available from India was so scanty that I was forced to content myself with recognising the two species *indica* and *cuvieri*. With the material now made available by the Survey, I have been encouraged to make a fresh examination of the forms contained in the Genus *Tatera* as restricted above.

The species of the Genus *Tatera*.

The Genotype and earliest species of *Tatera* to be described was *G. indicus* by Mr. Hardwicke in 1807. The type locality was given as "India." The type itself is in the National Collection, but faded almost beyond recognition and with its skull much damaged. In 1838 Mr. Waterhouse separated *cuvieri*, also giving the type locality as "India". This type is likewise in the National Collection, having been received from the Zoological Society so long as 60 years ago. A manuscript catalogue of that Society's Collection before it was dispersed, which has recently been found shows that the specimen was from Arcot, Madras. In 1843, Mr. Gray, in his List of Mammalia, published the name *G. hardwickei* without any description, but he placed under it as synonyms "G. indicus, Waterhouse and Mus (Gerbillus) indicus, Elliot." Waterhouse in describing his *cuvieri* compares certain of its characters with those of an animal which he calls "*Gerbillus indicus*, Hardwicke", these characters, however, are such that any determination of the exact animal referred to is impossible. Mr. Elliot, however, gives a very full description of the Dharwar *Tatera* (under the name *Gerbillus indicus*, Hardwicke) of which several specimens, unfortunately in very poor condition, contributed by Mr. Elliot himself, are in the National Collection. As Mr. Waterhouse recorded nothing which does not apply to this animal we are entitled, indeed constrained, to accept the Dharwar *Tatera* as the animal indicated under the name *hardwickei* by Mr. Gray and to consider Mr. Elliot's specimens as the co-types. Ten years ago (A.M.N.H. 7, Vol. XVII, p. 499, 1906) I named *T. ceylonica*, basing it on a single immature specimen very badly made up. The characters, I recorded, are, on more careful examination and comparison with Survey specimens, shown to be misleading. It is now clear that the type of *ceylonica* is really a young animal of the species of which very long series were obtained in Ceylon by Major Mayor. Next the series obtained by

Mr. Prater in Sind, proves to be quite distinct from any other found in India, resembling in its colouring as is not unnatural, the Persian species *tæniura*, *persica*, &c. Finally, some specimens collected by Col. Dunn, at Ambala, also require a name.

There are thus six species inhabiting India and Ceylon (but not Burma) which may be arranged in a key as follows :—

KEY.

A Feet and tail short, only exceptionally exceeding 40 and 190 mm. respectively.
  a General colour bright bay (Central India and Behar).
    (1) *Tatera indica*, Hardwicke.
  b General colour drab grey (Sind)
    (2) *Tatera sherrini*, sp.n
  c General colour pinkish buff (Ambala, Punjab).
    (3) *Tatera dunni*, sp.n.
B Feet and tail longer, at least 44 and 200mm. respectively.
  a Anterior palatal foramina very long (10mm.), general colour bay (South Maratha Country)
    (4) *Tatera hardwickei*, Gray.
  b Anterior palatal foramina short (6-7mm.).
    aa General colour buffy (South Madras)
      (5) *Tatera cuvieri*, Waterhouse.
    bb General colour reddish (Ceylon)
      (6) *Tatera ceylonica*, Wroughton.

(1) *Tatera indica*, Hardwicke.

Mr. Hardwicke describes this species as "bright bay, mixed with pencil-like strokes of dark brown longitudinally disposed." Unfortunately no really mature specimens were obtained by the Survey in Kumaon, from whence so many of Mr. Hardwicke's specimens were obtained, but I think there can be no doubt that the bright bay animal found throughout Behar, Khandesh, Central Provinces, Kathiawar and Palanpur belongs to this species. The dimensions given by Mr. Hardwicke (reduced to millimetres) are head and body 167; tail 175. The average of eight adult specimens from Behar and Khandesh is head and body 175; tail 190; hindfoot 40; and ear 24. The type skull is badly broken, but its greatest length is 46 mm. and from a skull of this length from Midnapur I record the following measurements, *viz.*:—Condylo-incisive length 41·5; zygomatic breadth 25; interorbital breadth 7; diastema 13; nasals 20; anterior palatal foramina 8·5; posterior palatal foramina 2·5; and upper molar tooth row 7.

So far as material is available it seems that the range of *indica* is Behar, the United Provinces, the Dekhan, and Gujerath.

(2) *Tatera sherrini*, sp. nov.

Size as in *indica*. Fur soft, silky, and fairly long (20-25 mm. on lower back). General colour above "ecru drab", below pure white. Face with usual pale markings before and behind the eyes. Feet white. Tail quadricolor, blackish above and below buff on the sides, tip (60-65 mm.) black, with lengthened hairs almost amounting to a tuft.

Skull smaller than in *indica* ; the anterior palatal foramina short, the posterior exceptionally long ; bullæ relatively large.

Dimensions of the type.—Head and body 162 ; tail 191 ; hindfoot 37 ; and ear 24.

Skull :—Greatest length 42 ; condylo-incisive length 37·5 ; zygomatic breadth 21 ; interorbital breadth 7 ; palatilar length 18·5 ; diastema 11·5 ; nasals 18 ; anterior palatal foramina 7 ; posterior palatal foramina 3·5 ; and molar tooth row 6.

Habitat.—Sind. Type from Jacobabad.

Type.—Old male. B. M. No. 15. 11. 1. 88. Original number 427. Collected by Mr. S. H. Prater on the 21st February 1915 and presented to the National Collection by the Bombay Natural History Society.

Altogether 22 specimens were obtained by the Survey. The contrast between the drab colouring of *sherrini* and the ochraceous of *indica*, or even the buff of *dunni*, is very marked, and in this *sherrini* seems to approach much more closely to *taeniura*, *persica*, &c., the Persian forms.

I have much pleasure in naming this very distinct species after Mr. W. R. Sherrin, of the Natural History Museum, who has given such invaluable assistance in organising the storage of the Survey material and in many other ways.

(3) *Tatera dunni*, sp. n.

A *Tatera* of the same size as *sherrini*, from which it is distinguishable by its pale buffy coloration.

Size as in *sherrini*. Fur soft and silky, but shorter than in that species (15-20 mm. on the lower back). General colour above "pinkish buff," below pure white. Otherwise as in *sherrini*.

Skull slightly longer and stouter than in *sherrini*, the anterior palatal foramina markedly longer.

Dimensions of the type.—Head and body 160 ; tail 190 (? the Collector recorded it as 203, but it had obviously been distorted, the other specimens gave much smaller figures) ; hindfoot, 37 ; ear 24. Skull :—Greatest length 44 ; condylo-incisive length

39; zygomatic breadth 22; interorbital breadth 7; palatilar length 20; diastema 12; nasals 19·5; anterior palatal foramina 8·5; posterior palatal foramina 2·5; upper molar tooth row, 6·5.

Habitat.—Ambala, Punjab.

Type.—Old male. B. M. No. 9. 4. 6. 10. Original number 254. Collected on 11th January 1909 and presented to the National Collection by Col. H. N. Dunn, R.A.M.C.

Eleven specimens are in the Collection. This species seems to me, judging by the skull, to be more related to *indica* than to *sherrini*, and it is possible that, when more material is available from Rajputana and the Punjab, it may be found to intergrade with the former.

(4) *Tatera hardwickei*, Gray.

As recorded above Mr. Gray based this name on Mr. Elliot's description of the Dharwar *Tatera*, which gave the colour as "uniform bright fawn" and the dimensions as:—Head and body 175; tail 202; hindfoot 50; ear 22·5 (these are converted measurements). These fairly correspond with those of the Survey material in the Dharwar, Kanara, and Koyna Valley Collections, except in the size of the hindfoot. I have never seen a *Tatera* with a hindfoot of 50 mm., so no doubt Mr. Elliot's measurement was taken differently from the method now employed, which gives an average of 44 mm. (max. 45). The skull is noticeable for its very long anterior palatal foramina. The following are the dimensions of the skull of an adult male from Dhawar, *viz.*, Greatest length 48; condylo-incisive length 41·5; zygomatic breadth 25; interorbital breadth 7; palatilar length, 21; diastema 13; nasals 21; anterior palatal foramina 10; posterior palatal foramina 2·5; upper molar tooth row 7.

This species extends from Dharwar District southwards along the wooded belt on the West Coast to Travancore, and north along the Konkan and Ghats, at least as far as Ratnagiri. We have not sufficient material to dogmatise on its extension inland, but we know that in the north it gives way to *indica* in Ahmednagar, and in the south to *cuvieri* in Bellary and Mysore.

(5) *Tatera cuvieri*, Waterhouse.

"General colour very bright cinnamon yellow" is Mr. Waterhouse's description, and he gives the dimensions as:—Head and body 177; tail 200; hindfoot 44; ears 15. These correspond very fairly with those of specimens from Seringapatam, Vijayanagar, Trichinopoly, &c., except that the ear measurement quoted is evidently not the same as that now in use. The type skull is badly broken, but I gather that its greatest length was about 44 mm. From the skull of an old female from Seringapatam, I can record the following

measurements, *viz.*, Greatest length 45; condylo-incisive length 39; zygomatic breadth 25; interorbital breadth 7; palatilar length 21; diastema 12; nasals 19; anterior palatal foramina 8; posterior palatal foramina 2; upper molar tooth row 7.

The range of *cuvieri* seems to be Bellary, Mysore and the whole country south of them, except the wooded Ghat strip on the West Coast.

(6) *Tatera ceylonica*, Wroughton.

I regret to say that in making these species I was misled by the condition of the solitary specimen, contributed by Mr. Kelaart. The fine series now available enables me to give a revised description of the species.

The general colour of the adult is very similar to that of *hardwickei* (not *cuvieri*, as would seem probable), but there is a somewhat larger admixture of black. The body dimensions are almost exactly those of *cuvieri*. The skull measurements of an adult female are as follows, *viz.*, Greatest length 47; condylo-incisive length 40; zygomatic breadth 23·5; interorbital breadth 8; palatilar length 20; diastema 12; nasals 20; anterior palatal foramina 7; posterior palatal foramina 2; upper molar tooth row 6·5.

Tatera ceylonica seems to be spread all over the Island.

(*B*) THE SLENDER LORIS OF MALABAR.

BY R. C. WROUGHTON.

When dealing with the Mysore Collection (Vol. XXII, p. 285, 1913) Miss Ryley explained that the name *gracilis* for the Ceylon Loris must give place to the much older *tardigradus*, and that these Mysore specimens must be known as *lydekkerianus*, Cabrera, being practically topotypes of that species. Later, on receipt of the Coorg Collection, not having specimens from Ceylon for comparison, she recorded them (Vol. XXII., p. 494, 1913) as *tardigradus*. Since then Major Mayor having obtained some specimens in the two Ceylon Collections (Nos. 13 and 18), I have now compared the three series of Loris and have come to the conclusion that the animals of Ceylon and Coorg belong to distinct species, and I propose to found a new species for the Malabar Loris under the name:—

Loris malabaricus, sp. n.

A Loris markedly smaller than either *tardigradus* or *lydekkerianus* with a strong russet tinge.

Size smaller than either *tardigradus* or *lydekkerianus*. General colour above "wood brown"* darker on the nape and upper back, but without any sign of a dorsal median dark stripe as in the

Mysore Loris. Hairs of dorsal area tipped with silvery as in the other forms. Below buff, dull white in the other two species.

Dimensions as below:—

	malabaricus.	*tardigradus.*	*lydekkerianus,*
Head and body	216	245	260
Tail	7	...	...
Hindfoot	45	51·5	54
Ear	25	32	32
Skull:—			
Greatest length	48	55	55
Condylo-basal length	41·5	46	47·5
Zygomatic breadth	29	34	35
Upper molar tooth row	13	14	15

The Collector records that the type of *malabaricus* had a tail 7 mm. long when taken. Probably all have a very short tail which is not appreciable in a skin.

Habitat.—Malabar. Type from Kutta, South Coorg.

Type.—A young adult female. B. M. No. 13. 8. 22. 3. Original number 2586. Collected by Mr. G. C. Shortridge, on the 21st February, 1913, and presented to the National Collection by the Bombay Natural History Society.

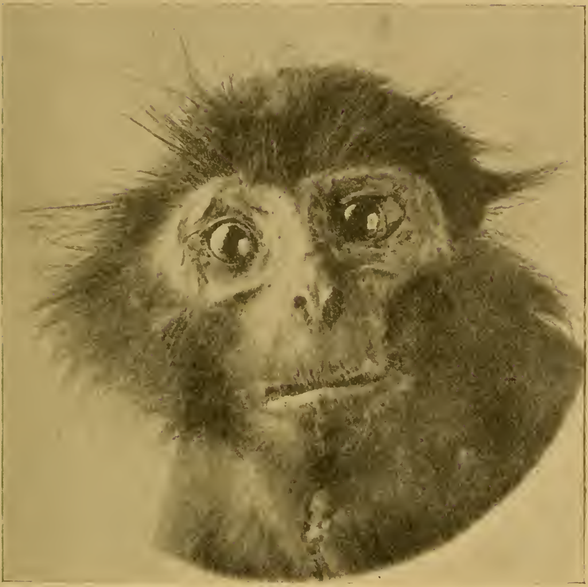
The Survey obtained altogether four specimens while another from Travancore in the British Museum Collection also belongs to this species.

(*C*) A NEW "LEAF MONKEY" FROM THE SHAN STATFS.

BY R. C. WROUGHTON.

When writing the Shan States Report (J. B. N. H. S., Vol. XXII., p. 715, 1914) Miss Ryley recorded the local leaf monkey as *P. phayrei*. In the Mt. Popa Report when true *phayrei* had been received, I suggested (Vol. XXIII, pp. 464-465, 1915) that the Shan States animal might be *barbei*.

Three descriptions of *barbei* are available, viz.—Blyth's original description (J. A. S. B., xvi., p. 734, 1847), another in his Catalogue of the Mammalia in the Museum of the Asiatic Society (p. 14, 1863), and a third by Anderson (Ind. Mus. Cat., i., p. 48, 1811). Both Blyth and Anderson note that the shoulders and forelimbs are pale (" silvered," " greyish brown "), but neither of them notices the radiation of the hair from a single central point on the forehead. I wrote to Dr. Annandale of the Indian Museum, Calcutta, who replied that the type of *barbei* " is an old specimen which has been mounted and exhibited for the last 70 years. There is no crest on the top of the beast's head and no definite whorl of hair." Dr. Annandale had the head photographed and most kindly sent me a copy which is here reproduced.



Head of the type of *Pithecus barbei*, Blyth.

This evidence seems to me conclusive that *barbei* belongs to the section of the langurs which have the hair laid straight back from the forehead over the crown. The Shan States langur has a distinct centre from which the hair radiates, on the forehead, and cannot therefore be *barbei*, I propose therefore to describe it as new under the name:—

Pithecus shanicus, sp. n.

A leaf monkey with the hair on the forehead radiating from a single central point; smaller than any other Indian species having this character; most nearly approaching (amongst them) *hypoleucos* in general colour, but wanting the black limbs of that species.

Size small. General colour above a slaty grey with a paler brownish tinge on the upper back; hind limbs and base of tail slightly washed with silvery; a dull whitish collar extending across the nape between (and including) the whiskers. Upper and lower lips white. Hands and feet black. Below sparsely haired, greyish white.

Skull more spherical (less elongate) and much smaller than in the true langurs; frontal ridges obsolescent, the flattened area immediately above them, so marked in *entellus*, *schistaceus*, &c., entirely absent, with a consequently shortened muzzle.

Dimensions of type.—Head and body 590; tail 755; hindfoot 168; ear 33. Skull:—Greatest length 107; condylo-basal length 83; zygomatic breadth 79; breadth across orbits 65; palatal length 37; upper molar tooth row 28.

Habitat.—Northern Shan States. (Type from Hsipaw, alt. 1,400′).

Type.—Adult male. B. M. No. 14. 7. 8. 5. Original number 3080. Collected by Mr. .G. C. Shortridge, on the 26th May 1913, and presented to the National Collection by the Bombay Natural History Society.

In all 20 specimens obtained. Dr. Anderson in his *Anat. and Zool. Researches* records having seen troops of monkeys, which he surmised to be *P. barbei*, but which were almost certainly these species "in the Valley of the Tapeng, in the centre of the Kakhyen hills" and again "in the defile of the Irrawaddy, above Mandalay, on the left bank of the river."

These species fall in Blanford's key, into Section A, on account of the whorl of hair on the forehead, this arrangement though convenient is quite artificial, for *shanicus* is in no way closely related to the true langurs, but, as already stated, to the leaf monkeys such as *obscurus*, &c.

(*D*) PARADOXURUS NIGER AND HERMAPHRODITUS OF BLANFORD.

By R. C. WROUGHTON.

Of the five species placed by Blanford in his key to the genus *Paradoxurus*, one he places in a section, "B," by itself. This species is now generally recognised as belonging to a distinct genus, *Paguma*, mainly on the characters used by Blanford. The two species *aureus* and *jerdoni*, from Ceylon and Malabar respectively, are such strongly marked forms that they too may be left out of consideration here. Thus there remain the two names *niger* and *hermaphroditus*, under which Blanford has ranged all the true toddy-cats.

On laying out all the available material for comparison, it at once becomes clear that we have not only two, but five forms, as follows, *viz.*:—(1) a northern peninsular form, (2) a southern peninsular form, (3) an Assam form, (4) a Burmese form, and finally (5) a northern Malay form, which extends into our limits, at any rate throughout Tenasserim.

The following is a list of the names given at various times to the Indian toddy-cats, *viz.*:—

1778. *V. hermaphrodita*, (Pallas), Schreb. Saüg., iii., p. 426.
1820. *V. prehensilis*, *nigra* and *bondar*, Desm. Mamm., pp. 208, 210.
1821. *P. typus*, F. Cuv., Hist. Nat. Mamm., pl. 186.
1828. *P. leucopus*, Ogilb., Zool. Journ., iv., p. 300.
1832. *P. pallasi*, *pennanti*, *crossi*, and *hamiltoni*, Gray, P. Z. S., pp. 65-68.
1836. *P. hirsutus*, Hodgs., As. Res., xix., p. 72.
1837. *P. strictus*, and *quadriscriptus*, Horsf., A. M. N. H. (2), xvi., pp. 105, 106.
1841. *P. felinus*, Wag., Schreb. Saüg., Supp. ii., p. 349.
1855. *P. quinquelineatus*, and *musangöides*, Gray, Ch. M. N. H., i., p. 579.
1864. *P. nigrifrons*, Gray, P. Z. S., p. 635.
1891. *P. nictitatans*, Tayl., J. B. N. H. S., vi., p.
1910. *P. vicinus*, Schw., A. M. N. H. (8), vi., p. 230.
1914. *P. hermaphryditus ravus*, Mill. Sm. Misc. Colls., lxi., 21, p. 2.

The name *hermaphroditus* undoubtedly represents a *Paradoxurus*, but is specifically indeterminable, and was recognised as such by Desmarest so long ago as 1820. The habitat was given as "Barbarey". Of Desmarest's three names the first, *prehensilis*, is I believe not specifically recognisable, the habitat is said to be Bengal. It is stated to be based on a drawing from a sketch by (?) B. Hamilton. The second name, *niger*, answers the description of the southern toddy-cat. Its despatch alive to Paris from Pondicherry confirms this diagnosis. It is true that Desmarest adds: "On la dit originaire des Molluques," but I attach little importance to this, which was more than probably the vendor's attempt to enhance the value of his goods. The third name, *bondar*, is again based on a sketch from one of (?) B. Hamilton's drawings, also with the habitat "Bengal". I cannot place it at all certainly, and find it safest to accept it as a synonym of *niger*, of which also the *typus* of Cuvier is another, as are also *leucopus*, Ogilb., and *nictitatans*, Taylor, these being albino examples from Orissa. Gray's names, *pallasi*, *pennanti*, *crossi* and *hamiltoni*, were all based on menagerie specimens and but for the fact that the types of *crossi* and *pallasi* are extant would all be indecipherable. These types show that *crossi* is the same species as *hirsutus*, Hodgson and *niger*, Desmarest. Horsfield's *strictus* and *quadriscriptus* represent the Assam form. Wagner's *felinus* and Gray's *nigrifrons*, *quinquelineatus*, and *musangöides*, based on animals in captivity, are all equally beyond recognition. Miller's *ravus* represents the Tenasserim form.

These five forms may now be arranged in a key, as follows, *viz.* :—

- *A.* Back and sides not or only obscurely striped and spotted. (North India) ... ... *crossi*, Gray.
- *B.* Back and sides distinctly striped and spotted.
  - *a.* Smaller, hindfoot 75-80 mm., greatest length of skull 105-110 mm. Ground colour gray. (South India) ... ... *niger*, Desmarest.
  - *b.* Larger, hindfoot 80-90 mm., greatest length of skull 115-120 mm.
    - a^1 Ground colour fulvous. (Assam) ... ... *strictus*, Horsfield.
    - b^1 Ground colour dull or buffy white ... ...
      - a^2 Crown of head black (Upper Burma) ... *birmanicus*, Wroughton.
      - b^2 No black crown (North Malay) ... *ravus*, Miller.

Paradoxurus crossi, Gray.

1832. *Paradoxurus crossi*, Gray, P. Z. S., p. 66.
1836. *Paradoxurus hirsutus*, Hodgson, As. Res., xix., p. 72.
1864. *Paradoxurus nigrifrons*, Gray, P.Z.S., p. 635.

A Paradoxurus showing ordinarily a mere smear of blackish (often amounting to a dark mauve brown rather than to black) on a grey ground.

Hair fairly long but rather coarse. Rarely showing definite stripes on the back and never the usual spots on the flanks. Hodgson records it from the Nepal Terai, whence it occurs westwards through Rohilcund, the Deccan and Central India to Rajputana.

Paradoxurus niger, Desmarest.

1820. *Viverra niger*, Desmarest, Mamm., p. 208.
1820. *Viverra bondar*, Desmarest, l. c., p. 210.
1821. *Paradoxurus typus*, F. Cuvier, Hist. Nat. Mamm., pl. 186.
1828. *Paradoxurus leucopus*, Ogilby, Zool. Journ., iv., p. 300 (albino).
1832. *Paradoxurus pallasi*, Gray, P. Z. S., p. 66.
1891. *Paradoxurus nictitatans*, Taylor, J. B. N. H. S., vi., p. 2.

A smaller animal than the preceding and either of the following. The stripes and spots very heavily marked in deep black on a grey ground. The type was from Pondicherry; it ranges however from

Orissa on the east to Ceylon in the south and the Southern Mahratha Country in the north.

Paradoxurus strictus, Horsfield.

1837. *Paradoxurus strictus*, Horsfield, A. M. N. H. (2), xvi., p. 105.
1837. *Paradoxurus quadriscriptus*, Horsfield, l. c., p. 106.
1910. *Paradoxurus vicinus*, Schwarz, A. M. N. H. (8), vi., p. 230.

A larger animal, about the size of *crossi*. Fur long and soft, the stripes and spots marked in black on a fulvous ground. Hodgson records it from the central region of Nepal, whence it ranges eastward through Darjiling, Bhutan Duars, and Assam. Schwarz's *vicinus* is a very brightly coloured specimen, with smaller measurements, but it is quite a young animal.

Paradoxurus birmanicus, sp. n.

A Paradoxurus of fully average size, with distinct black stripes and spots on a very pale, almost white, ground.

Size as in *strictus* and *crossi*. Fur shorter and coarser than in *strictus*. Head black, with the usual white blaze across the face, between the eyes and the ears. General colour above a dull white or very pale buffy grey, with the usual three median dorsal stripes, and with scattered spots arranged more or less in lines parallel to the stripes.

Skull as in *crossi*, &c., but lighter and somewhat smaller.

Dimensions of the type:—Head and body, 570; tail, 510; hindfoot, 85; ear, 48.

Skull:—Greatest length, 110; condylo-basal length, 109; zygomatic breadth, 60; palatilar length, 49; nasals, 25; back of m^1 to front of p^3, 19.

Habitat:—Burma. Type from Mingun, near Sagaing, Upper Burma.

Type:—Old female. B. M. No. 14. 7. 19. 89. Original number, 3261. Collected by Mr. G. C. Shortridge on 10th July 1913. Presented to the National Collection by the Bombay Natural History Society.

This species seem to extend throughout Burma, including the Shan States, till it meets the intruding North Malay toddy-cat (*P. ravus*) in Tenasserim. It would seem also to extend eastwards into Siam. Schwarz's *cochinensis* from Camboja, and Kloss's *kutensis* seem both to be of this type, though both are much smaller.

Paradoxurus ravus, Mill.

1914. Paradoxurus ravus, Miller, Sm. Mix., Colls., lxi., 21, p. 2.

Very similar to *birmanicus*, but easily recognisable by the absence of the black on the crown. The type locality is Trong, S. W. Siam, but it undoubtedly ranges through Tenasserim, and probably into South Pegu.

THE PALMS OF BRITISH INDIA AND CEYLON, INDIGENOUS AND INTRODUCED.

BY

E. BLATTER, S.J.

PART XVIII.

(With Plates XCVI to XCIX and 3 text figures.)

(Continued from page 688 of Volume XXIV.)

IV.—*LEPIDOCARYINŒ.*

Spadix branched once or more in a 2-ranked arrangement; flowers in concinni or 2-ranked spikes with bracts and bracteoles round them, carpels 3, fast united, covered with scales; fruit 1-seeded, covered with hard scales; feather or fan leaves, reduplicate.

4.—*Mauritieæ.*

Leaves fan-shaped with regularly or irregularly divided, slightly reduplicate segments. Flowers diœcious 1, dimorphic.

DISTRIBUTION.—Tropical America, east of the Andes between 16° S. L. and 12° N. L.

Mauritia L., *Lepidocaryum*, Mart. Not represented in India.

5.—*Metroxyleæ.*

Leaves paripinnate with regularly divided spinous pinnæ.

Flowers polygamous-hermaphrodite or diclinous.

DISTRIBUTION.—The moist tropics of the Old World.

Sub-tribe: *RAPHIEÆ.*

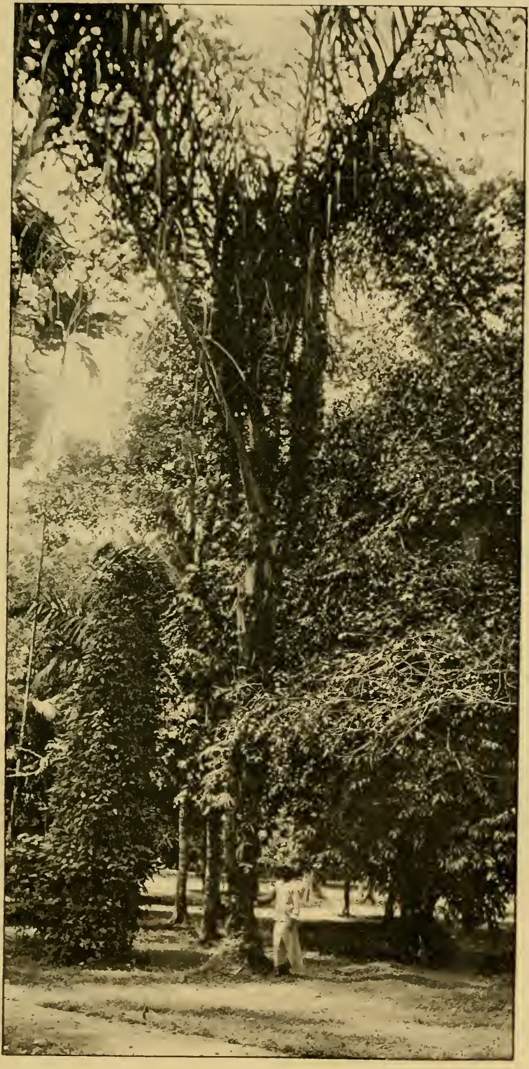
Flowers polygamous-hermaphrodite, or male and female flowers on the same branches of the inflorescence. Ovary completely 3-locular. Embryo horizontal.

DISTRIBUTION.—Africa on the coast of Guinea and inland to the sources of the Nile, also in East Africa on the coast of Zanzibar and perhaps in Western Madagascar.

RAPHIA, P. de B., Oncocalamus, Wendl. & Mann, *Ancistrophyllum*, Hook., *Eremospatha*, Wendl. & Mann.

RAPHIA, Beauv. Fl. Owar. I. 75, t. 44, fig. 1, 45, 46.

Lam. Illustr. t. 771.—Gaertn. Fruct. t. 40, f. 1.—Sprgl. Gen. Pl. 283 (*Metroxylon*)—Mart. Hist. Nat. Palm. II, 53, t. 45, 47, fig. 5, 48 (*Sagus*): III, 216, 343—Kth. Enum. Pl. III, 216.—Meissn. Gen. Pl. 265.—Griff. Palm. British India, t. 182.—Wallace Palm. Amaz. 42, t. 2, 16.—Mann & Wendl. Trans. Lin. Soc. 24, 437, t. 39, 42.—Oerst. Palm. Centroam. 1858. Drude in Fl. Brasil. III, II, 286, t. 61, 62.—Benth. & Hook. Gen. Pl. III, II, 935, 110.—Luers. Botan. II, 332.—Becc. in Webbia III (1910), 37—130.



Raphia Ruffia, Mart.

Large trees; stem short, stout, annulated. Leaves gigantic, regular, pinnate; leaflets linear with the midribs and edges spinulose; bases of the petioles sheathing, persistent some way down the stem, the margins fibrous.

Spadices growing from among the leaves about 3½ feet long, much branched. No common spathe, but many small, incomplete sheaths. Flowers monœcious, reddish-brown or greenish, male and female in separate bracts of the same branch. Male flowers: calyx campanulate, truncate; corolla triphyllous; stamens 6—8. Female flowers: calyx 3-dentate, corolla campanulate-infundibuliform, 3-partite half-way down. Ovary 3-locular; stigmas 3, sessile.

Berry with large imbricated scales, unilocular and 1-seeded by abortion. Seed cylindric oval, elongate-erect; embryo horizontal in the middle; albumen ruminate.

Species about 20.—Tropical Africa and America.

RAPHIA RUFFIA, Mart. Hist. Nat. Palm. III, 217; Kunth. Enum. Pl. III, 217; Wright in Th. Dyer. Fl. trop. Afr. VIII, 104 (partim); Drude in Engler Nat. Pflanzenf. I, 46, f. 36; Becc. in Agricolt. colon. IV. (1910), t. I; Webbia III (1910), 47.—*R. pedunculata* P. Beauv. in Desv. Journ. Bot. II, 87, et in Fl. d'Oware et de Benin, I, 78, t. 44, f. 2, et t. 46, f. 2.—*R. lyciosa et R. polymita* Comm. ex Kunth, Enum. Pl. III, 217.—*R. tamatavensis* Sadebeck in Engl. Bot. Jahrbücher, XXXVI (1905), 354.—*R. vinifera*, Drude (non Palis. de Beauv.) in Mart. Fl. Bras. v. III. pt. II, tantum in tab. 62, f. I. D.—*R. nicaraguensis* Oersted in Vidensk. Meddel naturhist. Forening, Kjöbenh. 1858 (1859) 52.—*R. vinifera var. nicaraguensis* Drude in Fl. Bras. l. c.—*Sagus farinifera*, Gaertn. Fruct. et Sem. II, t. 120, f. 3.—*Sagus Ruffia* Jacq. Fragm. 7; No. 27, t. 4, f. 2.—*Sagus pedunculata* Lam. Encycl. Suppl. V, 13, et Illustr. III, 357, t. 771, f. 2, a-g.—Sagus laevis. Griff. Palms Br. Ind., tantum in tab. CLXXXII.—*Metroxylon Ruffia* Spreng. Syst. II, 139.*

NAMES OF THE TREE.

English: Raffia, raffia palm, rafia palm, raphia palm, roffia, roffia palm.

French: Mouffia, palmier de Mayotte, raffia, rafia, raphia.

German: Bambuspalme, Madagaskarische Sagopalme, Raffiabastpalme, Raffiaweinpalme.

Dutch: Madagascarsche sagoboom, sagodragende palm.

NAMES OF THE FIBRE.

In Madagascar: Rafia.

English: Raffia, rafia fibre.

French: Raffia.

German: Bambuspalmenfaser, Raffia, Raffiafaser, Raphiastroh.

Dutch: Raffia, raffiabast, raffiabindbast, rafiavezel, raphia.

DESCRIPTION.—Stem up to 30 feet high and often (in very strong specimens) 3⅓ feet in diameter, ringed. Leaves rising straight

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* Synonymy ex Becc. l. c.

up, reaching 50 feet in length. Petiole very stout, relatively short, abruptly dilated at the base into a short and broad sheath surrounding the stem, deeply excavated on the upper side, convex on the lower; margins very acute, armed with short pale ascending spines, similar to those at the base of the segments. Segments very numerous, biseriate and more or less distinctly geminate on both sides of the rhachis, broadly linear, very slightly restricted towards the base, long-acuminate, very thinly coriaceous, rigid for the greater part of their length, green and shining above, whitish-pulverulent below. The segments vary as to length and breadth on the same leaf according to their position: the lowest are very acuminate; as long as the middle ones, but narrower, about $\frac{4}{5}$ inch broad, and more spinous than these. The central segments are distinctly geminate, the bigger ones 4-4$\frac{2}{3}$ feet long, sometimes up to 6 feet, and 1$\frac{1}{5}$-1$\frac{3}{5}$ inch broad, spinulose on the margins, more or less spinulose on the median rib, or also entirely unarmed. The segments near the apex become gradually smaller as to length and breadth, less distinctly geminate and entirely unarmed.

Spadix very large, rising successively from the axils of the highest leaves, first erect, then recurved and turned downwards; the same plant bears several spadices at the same time and of different age; they vary in length from 7-11 feet. Spadix cylindric, about 8 inches thick at the time of flowering; peduncle stout, recurved, slightly compressed, about 5 inches broad, sheathed below by 2 coriaceous, about 3$\frac{2}{3}$ feet long, spathes; the outer spathe acutely bicarinate; then follow other empty spathes which surround the peduncular part; and finally there are many others of which each bears in its axil a partial inflorescence. Partial inflorescences compressed, short and broad, 6-8 inches long, cuneate at the base, getting gradually broader towards the apex, divided into branches or floriferous spikelets of unequal length. Each partial inflorescence arises from the axil of a primary spathe which is rather broader than long and which terminates abruptly in an acuminate apex, being, on the whole, longer than the corresponding inflorescence. Primary spathes thinly coriaceous, of chestnut colour inside, hazel outside. Each inflorescence has a very short peduncular part which is strongly compressed, $\frac{4}{5}$-1$\frac{3}{5}$ inch long, $\frac{3}{5}$-$\frac{4}{5}$ inch broad, and sheathed by a short secondary spathe; this is narrowly sheathing, narrowly 2-winged, prolonged at the apex to the right and left into a very acuminate subfalcate and acutely carinate apex; the tertiary spathes, from the axils of which rise the spikelets, are close to each other, very shortly infundibuliform truncate at the apex, entire, non-ciliate, with a thin margin. Spikelets bearing perfectly bifarious flowers, vermiform, strongly compressed, slightly sinuose, about $\frac{2}{5}$ inch broad at the base, getting very slightly thinner towards the apex; the lowest ones are larger and measure 3-6 inches in length; the upper ones getting gradually shorter. Female flowers; ovate, acute $\frac{1}{3}$ inch long; involucellum membranaceous, yellow, forming a cupule almost complete or more or less split on the back, narrowly embracing the calyx. Calyx tubular-urceolate, truncate, entire and slightly narrowing at the mouth from which rise the conical apex of the ovary and the stigmas, which form a pyramidal trigonous, acute point. Corolla invisible externally, being entirely included in, and slightly shorter than, the calyx, divided into 3 large, broadly triangular, acuminate lobes. Staminodes forming a membranous cupule which is irregularly sinuous—6-dentate, the teeth being more or less triangular. Ovary ovate, stigmas 3, triangular, acute, connivent. Male flowers perfectly distichous and uniseriate, $\frac{3}{8}$ inch long and $\frac{1}{10}$ inch broad. Spathellule of male flower slightly longer than the calyx of its own flower, acutely bicarinate, shortly bidentate at the apex (fig. 1). Calyx tubular-cyathiform, superficially and obtusely 3-denticulate, slightly shorter than the corresponding spathellule. Stamens normally 6, sometimes 7-8, equal; filaments stout, clavate-fusiform, abruptly contracted at the connective, connate at the base; anthers linear, sagittate-auriculate below, obtuse. Corolla about twice as long as the calyx, subterete, divided to its lower fourth into 3 linear-lanceolate, thinly coriaceous segments.

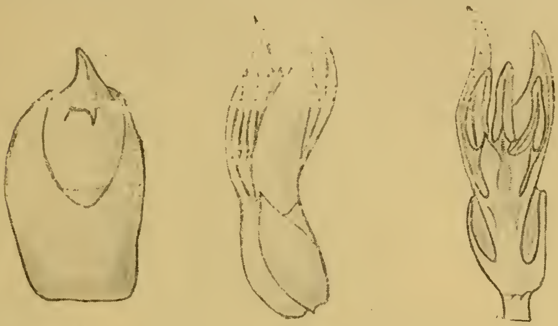


FIG. 1.—*Raphia ruffia*, Mart. Left: Female flower without spathellule, seen from the axile side. Middle: Male flower. Right: Median section of male flower. (After Beccari.)

Fruits variable in shape and size, 1-2 inches long, $1\frac{1}{2}$-$1\frac{4}{5}$ inch broad, more or less turbinate, or globose-ovate, and slightly longer than broad, or subglobose, always slightly depressed at the apex and terminated by a very short conical top, more or less attenuate below into an acute and symmetrical base, more rarely rotundate at the base. Scales disposed on 12-13 orthostichies, of chestnut or mahogany red colour, shining, strongly convex, deeply sulcate longitudinally, margin very narrow, scarious, blackish, fimbriate-ciliate, prolonged into an obtuse apex. Pericarp on the whole $\frac{1}{5}$-$\frac{1}{4}$ inch thick. Seed obovate, rotundate at the apex, more or less attenuate and acute below, sometimes $\frac{1}{24}$-$\frac{1}{12}$ inch thick, and still thicker at the base; albumen very hard, osseous, white and penetrated by intrusions of the integument which render it more or less ruminate. Embryo situated on one side, a little below the middle.

HABITAT.—Indigenous in Madagascar. Extensively cultivated on the Mascarene Islands. Naturalized in America.

ILLUSTRATION.—The specimen of *Raphia ruffia* shown on plate XCVI grows in the Botanic Gardens of Peradeniya. In the centre of the crown a fruiting spadix is visible. The palm was photographed by Mr. Macmillan.

RAPHIA VINIFERA, Palis. de Beauv. in Desvaux, Journ. de Bot. II, (1809) 87, et Fl. d'Oware et de Benin, I, 77, t. 44, f. 1, 45 (excl. syn. Gaertn.) et tab. 46, f. 1. a. b. c. d.; Martius Hist. Nat. Palm. III, 217 (ed. 1); Beccari in Webbia III (1910) 88.—*Sagus vinifera* Lam. Encycl., Suppl. V, 13 (?)—*Sagus Ruffia var. β* Willd. Sp. pl. IV, 404.—*Metroxylon viniferum* Spreng. Syst. veg. II, 139, n. 2.

NAMES OF THE TREE.

English : Bamboo palm, Jupati palm, Pharaoh's date-palm, wine palm.

French : Bourdon, palmier à vin, raphier.

German : Bambuspalme, Echte Weinpalme, Weingebende Sagopalme, Weinpalme.

Dutch : Raphiavezelpalm.

NAMES OF THE JUICE.

English : Palm wine, toddy.

French : Vin de palme.

German : Palmwein.

Dutch : Palmwijn.

NAMES OF THE FIBRE.

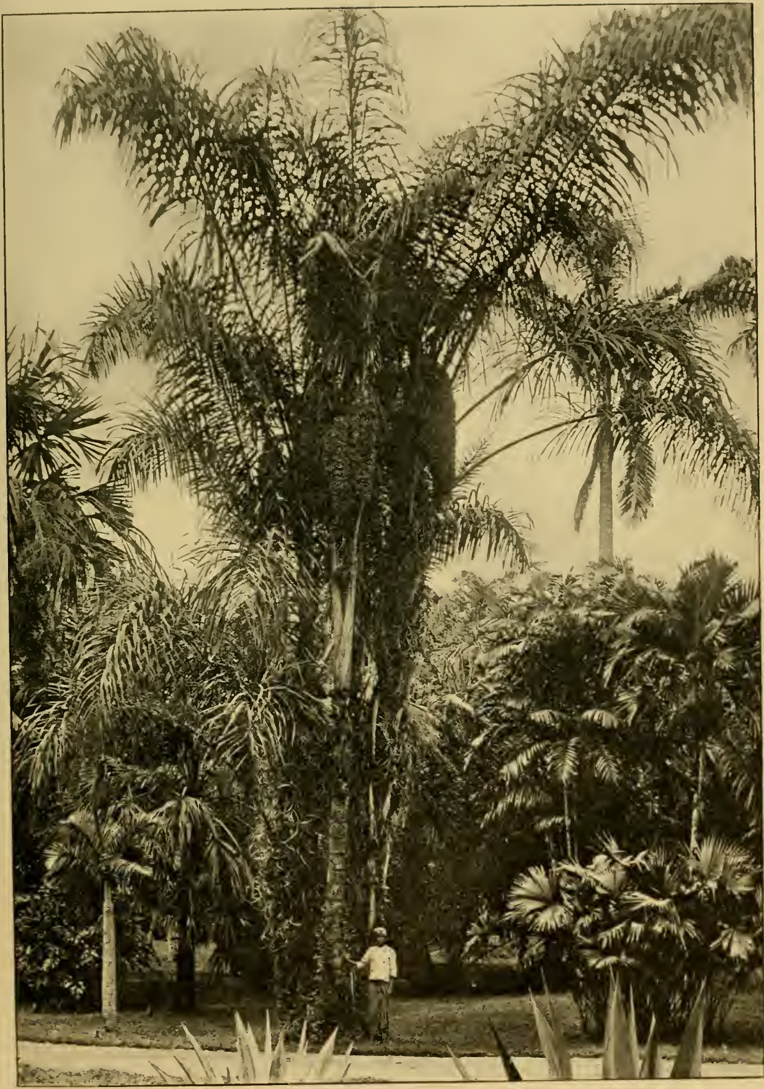
English : African bass, African bass fibre, Lagos bass, Lagos rafia, West African bass, West African bass fibre, West African piassava, West African rafia.

Dutch : West-Afrikaansche raffia.

Of the fibre from the young unopened leaves.

English : Raphia grass.

DESCRIPTION.—Stem comparatively short. Leaves rising nearly vertically from the stem, bending out on every side in graceful curves, forming a magnificent plume. Spadices very large, compoundly branched and drooping, growing from between the leaves and having numerous bract-like sheaths. Partial inflorescence on



WINE PALM (*Raphia vinifera*, Palis. de Beauv.).

the whole ovate, strongly compressed, with the spikelets densely arranged and distichous, about $\frac{5}{6}$ foot long comprising the peduncular part which measures about 3 inches and which is sheathed by some tubular spathes, of which the outermost is bi-winged and prolonged on both sides into a falciforme acuminate apex. The general spathe of the partial inflorescence is much dilated at the base and ends in a broad and rather long acuminate point, is opaque and hazel outside, shining and chestnut inside. Spikelets slightly arcuate, much compressed, of pectiform appearance on account of the regular arrangement of the flowers; the bigger ones situated on the lower third are 3_1-$3\frac{3}{5}$ inches. long; the upper ones become gradually shorter, about $\frac{1}{2}$ inch thick comprising the flowers; the spathellules are distinctly and densely ciliate-paleaceous on the margins. The flowers seem to be perfectly distichous. Male flowers (fig. 2): small, when fully developed $\frac{1}{3}$ inch long, curved calyx cyatiform, superficially 3-denticulate and ciliate-paleaceous on the margin, corolla about $2\frac{1}{2}$ times longer than the calyx, opaque on the outside, divided almost to the base into 3 linear segments. Stamens 9; filaments stout, subfusiform, free or more or less united at the base of the corolla. Female flowers (fig 2): about $\frac{2}{5}$ inch long and $\frac{1}{6}$ inch broad, acuminate, slightly attenuate at the base. Calyx not very deeply 3-lobed; lobes obtuse, ciliate-paleaceous on the margin, especially at the apex. Corolla by about $\frac{1}{3}$ longer

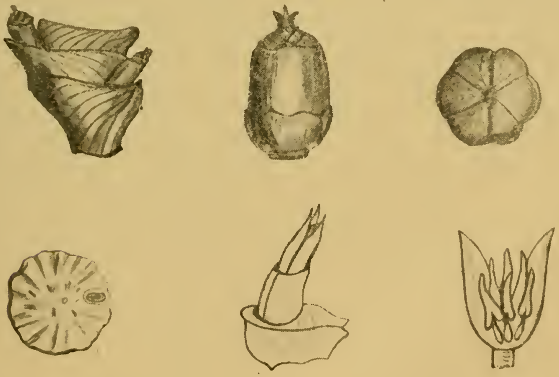


FIG. 2.—*Raphia vinifera*, P. D. B.
Upper row—Left : Two female flowers.
Middle : Single female flower.
Right : Seed seen from below.
Lower row—Left : Transverse section of seed with embryo.
Middle : Male flower with bract and bracteole.
Right : Male flower opened (after Drude).

than the calyx, divided half way down into 3 triangular elongate and accuminate segments. Staminodes united into a ring and connate with the corolla tube for the lower third of the latter, divided in the free part into 6 large triangular elongate and subulate teeth. Ovary pyramidal-trigonous; stigmas convergent.

Fruits cylindrical-ellipsoidal, equally broad below and above.

HABITAT.—Lower Nigeria.

USES.—A pleasant wine is obtained from *Raphia vinifera.* It is procured by cutting out the terminal inflorescence as soon as it makes its appearence; the wine is then procured in large quantities.

The petioles of the leaves are employed as poles upon which to carry palanquins. The leaflets are used for roofing.

ILLUSTRATION.—Mr. Macmillan was kind enough to take a photograph of a fine specimen of *Raphia vinifera* growing in the Botanic Gardens of Peradeniya. There arise from between the leaves about 6 flowering and fruiting spadices at different stages of development. (Plate XCVII.)

Sub-tribe: *CALAMEÆ.*

Flowers polygamous-monœcious, diclinous-monœcious or diœcius.

Ovary incompletely 3-locular.

DISTRIBUTION.—Scarcely touching tropical West Africa, the Calameæ begin with a great number of species on the tropical slopes of the Himalaya, pass through continental India to the Sunda and Malay Archipelago and finally to Polynesia on the one hand, and the tropical coast of Australia on the other.

Eugeissonia, Griff., *Metroxylon*, Rottb., *Pigafetta*, Bl., *Zalacca*, Reinw., *Korthalsia*, Bl., *Ceratolobus*, Bl., *Plectocomia*, Mart, *Plectocomiopsis*, Becc., *Calamus*, L., *Daemonorhops*. Bl.

KEY TO THE GENERA DESCRIBED BELOW.

A. Monocarpic palms, flowering once and then dying.
  I. Spadices axillary from the uppermost leaves.
    1. Stem scandent. Spadix with long amentiform branches clothed with large closely imbricating inflated spathels that conceal the spikelets of flowers .... 4. *Plectocomia.*
    2. Stem scandent. Spadix much branched, the branches having small infundibular spathels, each containing a small spikelet. Scales of fruit distinct .... 5. *Plectocomiopsis.*
  II. Spadix very large, terminal .... 1. *Metroxylon.*

B. Polycarpic palms, flowering annually.
  a. Leaflets acuminate, quite entire, nerves parallel.
    1. Stem elongate, spathes tubular, persistent .... 6. *Calamus.*
    2. Stem elongate; spathes cymbiform or open, deciduous............... 7. *Daemonorhops.*
    3. Stem short or absent; spathes many, persistent .... 2. *Zalacca.*
  b. Leaflects rhomboid cuneate or oblanceolate, toothed; nerves flabellate............................ 3. *Korthalsia.*

METROXYLON, Rottb., Nye Samml. Dansk. Selsk. Skrift. II, 525, t. 1 (from the Greek "metra," the heart of a tree, and "xylon," wood; in allusion to the large proportion of pith contained in the plant).

Mart. Hist. Nat. Palm. III, 213, 343, t. 102, 159.—Griff. Palm. Brit. Ind. 21, t. 181, append. XX.—Becc. Males. I, 91.—Benth. & Hook. Gen. Pl. III, II, 935, 109.

Stem erect, short, stoloniferous, in the lower part irregularly annulate, in the upper closed with the bases of fallen leaves. Leaves terminal, large, almost erect, pinnate; segments linear-lanceolate, acuminate, reduplicate, the edges and central vein often setose; petioles and sheaths often armed with long spines.

Spadices large, lasting for several years, lateral, decompound-distichously branched; spathes tubular, coriaceous. Flowers polygamous-monœcious on amentaceous branches. Calyx semi-trifid or tri-dentate; corolla tripartite. Male flowers: stamens 6, filaments united at the base with the corolla; anthers dorsifixed, subsagittate; pistillode consisting of more or less distinct carpels. Female flowers: incompletely trilocular; ovules erect, anatropous; styles and stigmas forming a pyramid; staminodes forming a six-dentate urceolus, barren anthers small or absent.

Berry with dry flesh, imbricate with retrorse scales, unilocular and 1-seeded by abortion; albumen deeply excavated or ruminate. Embryo dorsal. Species about 7.—Indian floral region.

USES.—*Metroxylon* furnishes the best sago. In order to procure it the trunk is split into logs a few feet long, their soft interior extracted, pounded, and thrown into water; the water is then drained off from the pulpy mass, when the starch comes away with it, and upon being allowed to settle is afterwards prepared and purified by successive washings. A tree fifteen years of age will yield from 600-800 pounds. The sago-meal, as it is called, is the form in which this starch is procured, although it is not commonly imported to Europe in this state. The usual form in which it is brought to the market is called Pear Sago. We follow Bennet in the description of the process by which this sago is prepared. The raw sago is a mass of rather soft consistence and of a dirty white colour, being mingled with several impurities. It first undergoes several different washings through cloth strainers. When the raw material is sufficiently clean, the masses at the bottom of the vessels are collected, broken into pieces, and placed upon platforms in the sun to dry, being broken into still smaller pieces as the drying proceeds. As soon as the pieces are sufficiently dry, they are pounded and sifted upon long benches through sieves made of the midrib of the leaves of the Coco-nut Palm, and placed at certain distances in a longitudinal direction, so as to cause the pulverized, or rather broken, masses of sago to pass through it of the size required. Having been passed through the sieve, a certain quantity at a time is taken, placed in a large cloth, tied to cross sticks, in the form of a bag, hanging by a cord from the roof of the building; the bag is then shaken forwards and backwards and the sago-powder itself must be occasionally shaken. This is continued for about ten minutes, when it is turned out granulated. It is then placed in small wooden hand-tubs, looking beautifully and delicately white, but still so soft as to break instantly with the slightest pressure under the fingers. It has then to undergo the drying process in large iron pans over a fire, where it is constantly stirred about with a wooden instrument. After this it is resifted at another bench and rebaked, when it is considered prepared. It is then of a fine pure white colour, and, being spread thinly over a long and large bin, in course of time becomes both harder and of a darker colour. The sago is collected just before the tree begins to show its large terminal flower spike. This generally occurs at the age of seven or eight years. When the flower and fruit are allowed to develop, which is in two years from the first appearance, the pith of the centre is found dried up, the leaves have fallen, and the tree perishes.

METROXYLON SAGUS, Rottb. in Nye Saml. K. Dansk. Vid. Skrift. II, 527; Miq. Fl. Ind. Bat. III, 147: Becc. in Nuov. Giorn. Bot. tal. III, 29.—*M. inermis* Mart. Hist. Nat. Palm. III, 215.—*Sagus lævis*, Rumph. Herb. Amb. I, 76; Blume Rumphia II, 147, t. 86; Griff. in Calc. Journ. Nat. Hist. v. 20; Palms Brit. Ind. 24 (not t. 182).—*S. Rumphii* Blume l. c. t. 126, 227.—? *S. Koenigi* Griff. ll. cc. 19, 22, t. 181.—*S. inermis* Roxb. Fl. Ind. III, 623.

Names.

English : Common sago palm, Rumphius's sago palm, sago palm, sago tree.
French : Arbre au sagon, palmier du Japon, palmier sagon, sagonier, sagonier farinifore, sagoutier.
German : Echte Sagopalme, Molukkische Zapfenpalme, Rumph's Sagopalme, Sagobaum, Sagopalme.

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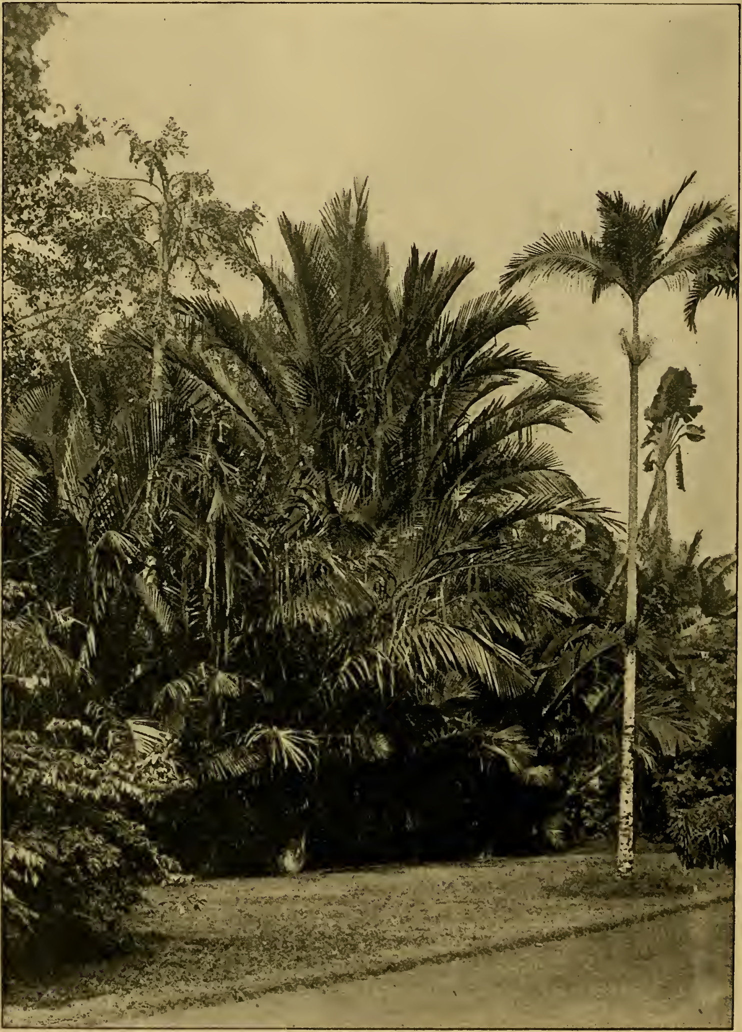
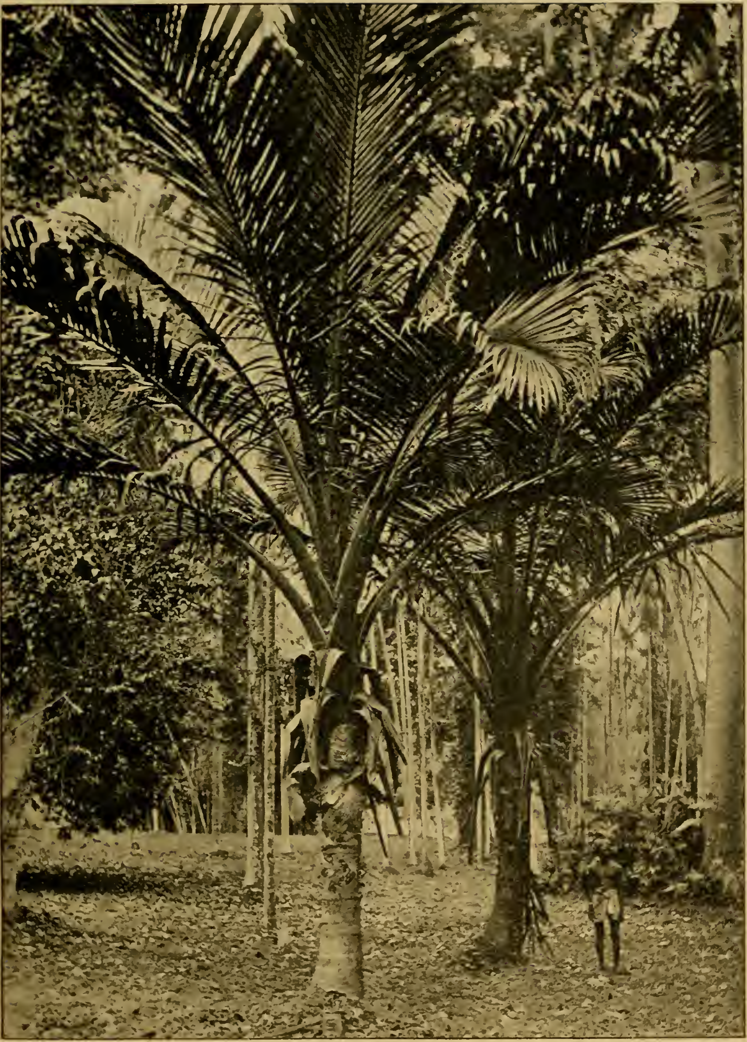


SAGO PALM (*Metroxylon Sagus*, Rottb.).



RUMPH'S SAGO PALM (*Metroxylon Rumphii*, Mart.).

Dutch : Meelboom, meelgevende palmboom, molueksche palmboom, sagoboom, sagoeboom, sagopalm.

NAMES OF THE FLOUR.

English : Sago, sago flour.
French : Farine de sagou.
German : Ostindische Graupen, Ostindische Tapiocca, Ostindischer Sago, Palmenstärke, Sago, Sagostärke.

Dutch : Bloem van sago, oostindisehe sago, palmensago, sagoe, sago sagoemeel, sagomel.

DESCRIPTION.—Stem about 20 feet high, with many basal offshoots, as stout as that of the coconut-palm, annulate, covered above with the bases of fallen leaves. Leaves resembling those of the coconut, but more erect, unarmed; segments linear, acute, keeled, smooth. Inflorescence developing when the tree is about 20 years old.

Spadices several, terminal, alternately branched; spikes 5-8 inches long. Spathes unarmed. Flowers minute, sunk in rusty wool, scarcely larger than a grain of mustard seed, bisexual.

Fruit globose, size of a small apple ; scales shining, channelled (Jack). The fruit takes 3 years to ripe.

HABITAT.—Malacca, Malay Islands.

ILLUSTRATION.—We have to thank Mrs. Burkill for kindly taking the photograph (reproduced on pl. XCVIII) in the Botanic Garden of Singapore.

METROXYLON RUMPHII, Mart. Hist. Nat. Palm. III, 213, 313, t. 102, 159 ; Miq. Fl. Ind. Bat. III, 140 ; Becc. in Nuov. Jor. Bot. Ital. III, 30 ; Malesia I, 91 ; Becc. and Hook. f. Fl. Brit. Ind. VI, II, 481.—*Sagus Rumphii*, Willd. Sp. Pl. IV, 404 ; Roxb. Fl. Ind. III, 623.—*S. genuina* Blume Rumphia II, 150.—*S. farinifera*, Gaertn. II, 186, t. 120, f. 3 ; Rumph Herb. Amb. I, 75, t. 17, 18.

NAMES.—Rumph's Sago-Palm ; Sagu (Malay). See also the names mentioned under foregoing species.

DESCRIPTION.—Stem 25-30 feet high, soboliferous. Leaves 20 feet long and more ; leaflets linear-lanceolate, acuminate, 2-4 feet long, 1—several inches broad, on the edges and central nerve setose; sheath coriaceous, 3 feet long ; petiole densely covered with spines which are ½-1½ inches long. Spadix 12-15 feet long, the secondary branches 18-12 inches long ; spathes of the first and second order coriaceous tubular, obliquely truncate, armed with compressed, blackish spines. The catkin-like spikes cylindric, 2½ inches long of the size of the little finger, densely compact with bracts and bracteoles ; bracts suborbicular or transversely elliptic, 1½ lines long, coriaceous-membranous ; bracteoles 1 line long, campanulate, compressed. Calyx campanulate, trifid ; sepals ovate, acute, longitudinally nervose, corolla trifid below the middle; petal oblong-ovate. Male flowers (fig. 3): Stamens 6, as long as the corolla; filaments united into a subcylindric tube, attached to the base of the corolla, subulate; anthers linear, dorsifixed; pistillode slightly shorter than the corolla; styles and stigmas 3. Female flowers (fig. 3): Staminodes forming a membranous, 6-fid urceolus, united with the corolla. Berry depressed-globose, $1\frac{1}{2}$ inches in diameter, crowned with the style, with imbricate scales. Scales rhomboid, convex, with a median vertical furrow, the edges ciliate. Flesh spongy, dry. Seed globose, rugulose.

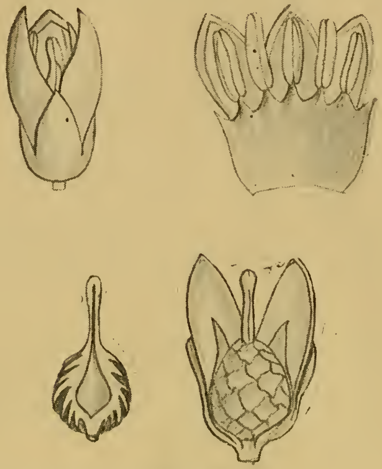


FIG. 3.—*Metroxylon Rumphii*, Mart.
Upper left: Male flower.
,, right: Corolla of male flower opened.
Lower left: Longitudinal section of pistillode of male flower.
,, right: Part of female flower showing he fertile ovary and two staminodes. (after Martius.

HABITAT.—Malay Archipelago.

ILLUSTRATION.—Mr. Macmillan has supplied us with the photogaph of Rumph's Sago Palm which grows in the Botanic Garden of Peradenya. There are two specimens visible on Pl. XCIX, both without either flower or fruits.

(*To be continued.*)

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON.

REPORT NO. 27, BHUTAN DUARS.

BY R. C. WROUGHTON.

COLLECTION ... ... No. 27.
LOCALITY ... ... Bhutan Duars.
DATE ... ... October, 1915; May, 1916.
COLLECTED BY ... ... N. A. Baptista.
EARLIER REPORTS .. .. No. 1, East Khandesh, Vol. XXI, p. 392, 1912; No. 2, Berars, Vol. XXI, p. 820, 1912; No. 3, Cutch, Vol. XXI, p. 826, 1912; No. 4, Nimar, Vol. XXI, p. 844, 1912; No. 5, Dharwar, Vol. XXI, p. 1170, 1912; No. 6, Kanara, Vol. XXII, p. 29, 1913; No. 7, Central Provinces, Vol. XXII, p. 45, 1913; No. 8, Bellary, Vol. XXII, p. 58, 1913; No. 9, Mysore, Vol. XXII, p. 283, 1913; No. 10, Kathiawar, Vol. XXII, p. 464, 1913; No. 11, Coorg, Vol. XXII, p. 486, 1913; No. 12, Palanpur, Vol. XXII, p. 684, 1914; No. 13, S. Ceylon, Vol. XXII, p. 700, 1914; No. 14, Shan States, Vol. XXII, p. 710, 1914; No. 15, Kumaon, Vol. XXIII, p. 282, 1914; No. 16, Dry Zone, Central Burma & Mt. Popa, Vol. XXIII, p. 460, 1915; No. 17, Tenasserim, Vol. XXIII, p. 695, 1915; No. 18, Ceylon, Vol. XXIV, p. 79, 1915; No. 19, Bengal, Vol. XXIV, p. 96, 1915; No. 20, Chindwin, Vol. XXIV, p. 291, 1916; No. 21, Gwalior, Vol. XXIV, p. 309, 1916; No. 22, Koyna Valley, Vol. XXIV, p. 311, 1916; No. 23, Sikkim, Vol. XXIV, p. 468, 1916; No. 24, Sind, Vol. XXIV, p. 749, 1916; No. 25, Chin Hills, Vol. XXIV, p. 758, 1916; No. 26, Darjiling, Vol. XXIV, p. 773, 1916.

On the conclusion of the work recorded in "Report No. 26, Darjiling District," Baptista and his party moved eastwards about 60 miles to the Hasimara Tea Estate, where Mr. H. V. O'Donel had volunteered to supervise their work. The following note by Mr. O'Donel describes the country in which the present collection was made, between October 15th, 19, and May 10, 1916.

"The Hasimara Tea Estate, around which the collection was principally made, is situated in the Toorsa-Jainti Sub-Division of the Jalpaiguri District, or what is locally known as the Bhutan Duars (Gates of Bhutan). It lies on the east bank of the Toorsa River, some eight miles from the Bhutan Hills, about 26·50 N. Lat. and 89·20 E. Long. at an altitude of 500-600 feet.

"The rainfall is heavy, the average for the year being 150 inches.

"The country is more or less flat in appearance, but a decided slope leads up to the base of the hills.

"A fair portion of the District is under tea cultivation, the greater part however being occupied by heavy forest, with stretches of high grass and reed jungle; intersected by numerous streams, which are dry during the winter but become formidable torrents during the rains.

"The larger mammalia are well represented, the Elephant (*E. maximus*), the Gaur (*B. gaurus*), and Rhinoceros (*B. unicornis* and *sondaicus*) still occur, as well as *Bos bubalis*, *Rusa unicolor*, *Axis axis*, *C. duvaucelli*, *C. porcinus*, and *Sus salvanius*; Tigers and Leopards are plentiful and a few Himalayan Bear (*U. torquatus*) are also found. Among the smaller species which occur but were not procured by the Survey, *C. dukhunensis*, the Indian Wild Dog; *V. bengalensis*, Indian Fox; *F. bengalensis*, the Leopard Cat; *H. personata*, the Burmese Ferret Badger; *R. gigantea*, the Himalayan Giant Squirrel; *L. hispidus*, the Hispid Hare."

The collection consists of 886 specimens, belonging to 48 species and sub-species, in 38 genera.

No strikingly new form was obtained, and only two are new to the Survey lists, of which one (the porcupine) is doubtfully identified owing to too scanty material. As showing however the quantitative distribution of forms, these latter collections are most welcome.

Thus *Vandeleuria* has been represented in former collections by one or two specimens in each, while here we have a series of 50 specimens, showing that this animal is by no means so rare as we might have been led to believe by our past experience; and the Pigmy Shrew is another similar case.

(1) MACACA RHESUS, Audeb.

The Bengal Monkey.

Synonymy in No. 7.

♂ 2, ♀ 2, Hasimara; ♂ 1, Bharnbari.
(*See* also Reports Nos. 7, 14, 15, 19, 23 and 26.)

(2) PTEROPUS GIGANTEUS, Bruenn.

The Common Flying Fox.

Synonymy in No. 2.

♂ 2, ♀ 2, Hasimara.
(*See* also Reports Nos. 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 15, 18, 19, 22 and 23.)

(3) CYNOPTERUS SPHINX, Vahl.

The Southern Short-nosed Fruit Bat.

Synonymy in No. 6.

♂ 3, ♀ 4, Hasimara; ♂ 1, Bharnabari.
(*See* also Reports Nos. 9, 11, 13, 14, 15, 18, 19, 20, 22 and 23.)

(4) ROUSETTUS LESCHENAULTI, Desm.

The Fulvous Fruit Bat.

Synonymy in No. 11.

♂ 1, Hasimara.
(*See* also Reports Nos. 11, 15, 16, 17, 22.)

(5) LYRODERMA LYRA, Geoff.

The Indian Vampire Bat.

Synonymy in No. 1.

♀ 1, Hasimara.
(*See* also Reports Nos. 4, 5, 6, 7, 8, 9, 12, 14, 15, 19, 22 and 23.)

(6) RHINOLOPHUS AFFINIS, Horsf.

The Allied Horse-shoe Bat.

Synonymy in No. 20.

♂ 1, Hasimara.
(*See* also Report No. 20.)

(7) HIPPOSIDEROS FULVUS, Gray.

The Bicoloured Leaf-nosed Bat.

Synonymy in No. 3.

♂ 1, Hasimara.
(*See* also Reports Nos. 5, 6, 7, 8, 9, 10, 12, 13, 14, 16, 17, 18, 19, 22, 23, 24 and 26.)

(8) BARBASTELLA DARJILINGENSIS, Horsf.

The Eastern Barbastel.

Synonymy in No. 26.

♀ 1, Hasimara.

(9) PIPISTRELLUS BABU, Thos.

The Babu Pipistrel.

Synonymy in No. 26.

♂ 3, ♀ 1, Hasimara.

(10) PIPISTRELLUS COROMANDRA, Gray.

The Coromandel Pipistrel.

Synonymy in No. 5.

♂ 5, ♀ 2, Hasimara ; ♂ 4, ♀ 4, Bharnabari.
(*See* also Reports Nos. 9, 11, 13, 14, 15, 19, 23 and 26.)

(11) PIPISTRELLUS MIMUS, Wr.

The Southern Dwarf Pipistrel.

Synonymy in No. 1.

♂ 19, ♀ 20, Hasimara ; ♂ 2, Bharnabari.
(*See* also Reports Nos. 1, 2, 5, 6, 7, 8, 9, 10, 11, 13, 15, 18. 19, 20, 23 and 25.)

(12) SCOTOZOUS DORMERI, Dobs.

Dormer's Bat.

Synonymy in No. 1.

♂ 2, ♀ 2, Bharnabari.
(*See* also Nos. 2, 5, 7, 8 and 19.)

(13) SCOTOPHILUS KUHLI, Leach.

The Common Yellow Bat.

Synonymy in No. 1.

♂ 20, ♀ 16, Hasimara; ♂ 8, ♂ 7, Bharnabari.
(*See* also Reports Nos. 3, 5, 6, 7, 9, 12, 14, 15, 16, 19, 20, 23 and 24.)

(14) SCOTOPHILUS WROUGHTONI, Thos.

Wroughton's Bat.

Synonymy in No. 1.

♂ 3, ♀ 6, Hasimara.
(*See* also Reports Nos. 5, 6, 7, 9, 10, 11, 12, 15, 16, 18, 19 and 23.)

(15) HESPEROPTENUS TICKELLI, Blyth.

Tickell's Bat.

Synonymy in No. 5.

♂ 2, ♀ 3, Hasimara; ♀ 1, Bharnabari.
(*See* also Reports Nos. 6, 18 and 19.)

(16) HARPIOCEPHALUS LASYURUS, Hodgs.

The Hairy-winged Bat.

1847. *Noctilinia lasyura*, Hodgson, J. A. S. B., xvi, p. 896.
1851. *Lasiurus pearsonii*, Horsfield, Cat. p. 36.
1891. *Harpyiocephalus harpyia*, Blanford, Mammalia, No. 200.
♂ 1, Hasimara.

(17) MYOTIS MURICOLA, Gray.

The Wall Bat.

Synonymy in No. 17.

♂ 16, ♀ 10, Hasimara.

(18) TUPAIA BELANGERI CHINENSIS, And.

The Sikkim Tree Shrew.

Synonymy in No. 23.

♂ 10, ♀ 3, Hasimara; ♂ 2, ♀ 2, Bharnabari.

(19) PACHYURA, SP.

The Musk Rat.

♂ 37, ♀ 33, Hasimara.
(*See* also Reports Nos. 1, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 22 and 23.)

(20) Pachyura hodgsoni, Blyth.

The Himalayan Pigmy Shrew.

Synonymy in No. 15.

♂ 9. ♀ 16, Hasimara.
(*See* also Reports Nos. 16, 19, 23 and 26.)

(21) Soriculus caudatus, Horsf.

Hodgson's Brown-toothed Shrew.

Synonymy in No. 15.

♂ 8, ♀ 5, Hasimara, ♂ 1, ♀ 1, Bharnabari.
(*See* also Reports Nos. 23 and 26).

(22) Felis pardus, L.

The Panther.

Synonymy in No. 5.

♀ 1, Bharnabari.
(*See* also Reports Nos. 6, 9, 11, 13, 14, 16, 18 and 19.)

(23) Felis affinis, Gray.

The Jungle Cat.

Synonymy in No. 1.

♂ 1, Hasimara.
(*See* also Reports Nos. 3, 4, 5, 6, 7, 10, 11, 12, 15, 16, 18, 19, 20, 22 and 24.)

(24) Felis (Domestic).

♂ 1, Hasimara.
(*See* also Reports Nos. 9, 11, 14, 15, 18, 19, 24 and 27.)

(25) Viverra zibetha, L.

The Large Indian Civet.

Synonymy in No. 14.

♂ 4, ♀ 3, Hasimara; ♂ 2, ♀ 1, Bharnabari.
(*See* also Reports Nos. 20, 23, 25 and 26.)

(26) Viverricula malaccensis, Gmel.

The Small Indian Civet.

Synonymy in No. 3.

♂ 5, ♀ 4, Hasimara; ♂ 1, Bharnabari.
(*See* also Reports Nos. 5, 7, 10, 11, 12, 13, 15, 16, 18, 19, 20, 22, 23, 24 and 25.)

(27) Paradoxurus niger, Desm.

The Indian Toddy Cat.

Synonymy in No. 5.

♂ 6, Hasimara; ♂ 1, Bharnabari.
(*See* also Reports Nos. 7, 8, 11, 13, 15, 18, 19 and 22.)

Some of these specimens correspond with the type of *vicinus*, Schwarz, while some are quite normal and even in the dentition I can appreciate no difference between the two forms. Schwarz relies largely on the yellow suffusion and gives the habitat as Assam, it may be that later we may find that all the animals in Assam show this yellow suffusion in which case there may be reason to accept *vicinus* as a subspecies, but in the meantime I think it is safer to use the specific name *niger*.

(28) MUNGOS MUNGO, Gmel.

The Common Bengal Mongoose.

Synonymy in No. 19.

♂ 2, Hasimara.
(*See* also Reports Nos. 21 and 23).

(29) MUNGOS AUROPUNCTATUS, Hodgs.

The Small Indian Mongoose.

1836. *Mangusta auropunctata*, Hodgson, J. A. S. B., v., p. 235.
1888. *Herpestes auropunctatus*, Blanford. Mammalia, No. 58.
♂ 16, ♀ 2, Hasimara; ♂ 1, ♀ 3, Bharnabari.

We have already had occasion to take *pallipes* out of Blanford's synonymy of this species, and *persicus* is equally distinct, *nepalensis* has hitherto been represented only by Gray's original three lines of description; recently however, Mr. Thomas, in going through a number of stuffed specimens, withdrawn from public exhibition, was able to identify one of them as the type of Gray's *H. nepalensis*. It now appears that, though the two animals closely resemble each other in many respects, *nepalensis* is distinguishable by its finer pattern. The type locality of *nepalensis* is given by Gray as "N. India." It appears to be a rare animal. The National Collection contains no specimen except the type, and from its absence from the long series collected by Hodgson in Nepal, and from his drawings, it seems very doubtful whether it occurs at all in that country. On re-examining the Survey stock I find that Mr. Crump obtained two specimens in Midnapur, recorded in the Bengal, Behar and Orissa Report, under the name of *auropunctatus*, which appear to me to represent *nepalensis*.

In the circumstances it will be interesting to record some measurements of the two species:—

—	*auropunctatus.*		*nepalensis.*	
	♂	♀	♂	♀
Head and body..	300	290	300	275
Tail	237	238	217	221
Hindfoot..	53	52	52	49
Ear	20	20	22	23
Skull :—				
Condylo-basal length	61	61	61	60
Zygomatic breadth	29	29	29	28
Interorbital breadth..	14	10	11	10
Nasals length..	13	12	15	16
Palatilar length	32	33	32	30
Greatest length of carnassial	7·3	7·5	7	7

(30) MUNGOS URVA, Hodgs.

The Crab-eating Mongoose.

Synonymy in No. 23.

♂ 1, ♀ 1, Hasimara.

(*See* also Report No. 25.)

(31) MARTES FLAVIGULA, Bodd.

The Northern Indian Marten.

Synonymy in No. 15.

♀ 1, Hasimara.

(*See* also Reports Nos. 20, 23 and 25.)

(32) CANIS INDICUS, Hodgs.

The Bengal Jackal.

♂ 1, ♀ 1, Hasimara.

(*See* also Reports Nos. 14, 15, 16, 19, 20, 23 and 25.)

(33) PTEROMYS (HYLOPETES) ALBONIGER, Hodgs.

The Parti-coloured Flying Squirrel.

Synonymy in No. 20.

♂ 1, Hasimara ; ♀ 1, Bharnabari

(*See* also Reports Nos. 23, 25 and 26.)

(34) TOMEUTES LOKROIDES, Hodgs.

The Hoary-bellied Himalayan Squirrel.

Synonymy in No. 23.

♂ 4, ♀ 7, Hasimara ; ♂ 9, ♀ 1, Bharnabari.

(*See* also Report No. 26.)

(35) VANDELEURIA DUMETICOLA, Hodgs.

Hodgson's Tree Mouse.

Synonymy in No. 16.

♂ 17, ♀ 17, Hasimara ; ♂ 8, ♀ 7, Bharnabari.

(*See* also Reports Nos. 23, 25 and 26.)

(36) MUS DUBIUS, Hodgs.

The Nepal House Mouse.

Synonymy in No. 15.

♂ 19, ♀ 19, Hasimara.

(*See* also Reports Nos. 23 and 26.)

(37) MUS HOMOURUS, Hodgs.

The Himalayan House Mouse.

Synonymy in No. 15.

♂ 6, ♀ 8, Hasimara ; ♂ 6, ♀ 5, Bharnabari.

(*See* also Reports Nos. 23 and 26.)

(38) MUS BOODUGA, Gray.

The Southern Field Mouse.

Synonymy in No. 1.

♂ 29, ♀ 55, Hasimara ; ♂ 33, ♀ 40, Bharnabari.

(*See* also Reports Nos. 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22 and 25.)

(39) RATTUS RUFESCENS, Gray.

The Common Indian Rat.

Variety with white underparts :—

♂ 66, ♀ 60, Hasimara.

(*See* also Reports Nos. 5, 6, 7, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25 and 26.)

(40) GUNOMYS BENGALENSIS, Gr. and Hardw.

The Bengal Mole-Rat.

Synonymy in No. 19.

♂ 17, ♀ 21, Hasimara.

(*See* also Reports Nos. 20, 23 and 26.)

(41) BANDICOTA ELLIOTANA, And.

The Bengal Bandicoot.

Synonymy in No. 19.

♂ 3, ♀ 2, Hasimara.

(*See* also Reports Nos. 19 and 27.)

(42) GOLUNDA ELLIOTI, Gray.

The Indian Bush Rat.

Synonymy in No. 1.

♂ 8, ♀ 6, Hasimara.

(*See* also Reports Nos. 2, 4, 5, 6, 7, 11, 15, 19 and 22.)

(43) ACANTHION HODGSONI, Gray.

The Crestless Himalayan Porcupine.

1847. *Acanthion hodgsonii*, Gray, P. Z. S., p. 101.
1847. *Hystrix alophus*, Hodgson, J. A. S. B., xvi., p. 771.
1891. *Hystrix hodgsoni*, Blanford, Mammalia, No. 316.

♂ 1, Hasimara.

The specimen is a head—skin and skull of a quite young animal, there is however no sign whatever of a crest, showing that it is not *leucurus*. I can find no authentic record of any specimen of *bengalensis* having been taken since Blyth described the species, and I have not access to the type. For the present it will be safest to call this specimen *hodgsoni*. Hodgson himself called the animal *alophus* but his description was not published till August, while Gray's appeared in June. A good series of these small crestless porcupines is a great desideratum, for though Blyth writes of it as the " common Bengal Porcupine " the National Collection contains only two or three specimens of *hodgsoni* contributed by Hodgson himself, and none of anything resembling *bengalensis*.

(44) Lepus ruficaudatus, Geoff.

The Bengal Hare.

Synonymy in No. 15.

♂ 11, ♀ 1, Hasimara ; ♂ 1, Bharnabari.
(*See* also Reports Nos. 19, 21, 23 and 26.)

(45) Muntiacus vaginalis, Bodd.

The Bengal Rib-faced Deer.

Synonymy in No. 20.

♂ 1, Hasimara.
(*See* also Report No. 23.)

(46) Rusa unicolor, Bechs.

The Sambhar.

Synonymy in No. 5.

♀ 1, Bharnabari.
(*See* also Reports Nos. 11, 15, 18 and 22.)

(47) Sus cristatus, Wagn.

The Indian Wild Boar.

Synonymy in No. 5.

♀ 1, Hasimara.
(*See* also Reports Nos. 8, 10, 11 and 22.)

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A LIST OF BIRDS FROM THE NORTH CHIN HILLS.

BY

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AND

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This list is the result of three short trips at dates varying from April 20th to May 18th. In 1913, Hopwood went up to the hills on May 6th and came down on May 16th, in 1914, he and I went up together on April 22nd and came down on May 9th, and in 1915 I was up in the hills alone from April 20th to May 18th. Travelling in the hills is exceedingly difficult and expensive, and except in 1913 the weather was unspeakably bad; in all three years, we had a certain amount of illness, and a good deal of work had to be done, ornithology perforce taking second place; added to this, we both plead guilty to a desire for getting nest and eggs with the birds secured. These things account for the somewhat meagre list produced. It is given for what it is worth, as several very rare birds were found, and the district itself is interesting, lying between Manipur worked by Hume, and the Chin Hills worked by Col. Rippon and Capt. F. E. W. Venning, the former at Mt. Victoria, the latter at Haka. A little further North, on the South of Assam lie the unexplored (and unadministered) ranges of hills inhabited by Chins, Nagas, Abors, etc., including Mt. Saramatti, the highest mountain in Burma, of which the ornithology is absolutely unknown, except by inference.

In the hope of adding a little to what has been recorded from this part of the world, which has been very little worked, we venture to give a list which has no pretensions to being perfect; quite on the contrary, it comprises merely the commoner birds occurring in the summer. Only one or two specimens shot in the cold weather (and these all low down) are included; unless otherwise stated, all the birds given were secured between April 20th and May 18th. The numbers in brackets refer to the Fauna of British India, and trinomials, when used, are either those given by the late Col. H. H. Harington, in his notes on the "Indian Timeliides and their allies", (J.B.N.H.S., June 1914, *et seq.*), or those in Mr. E. C. Stuart Baker's Indian Pigeons and Doves.

Our thanks are due to both these gentlemen for a great many very useful hints, and for very kindly working out some of the skins obtained.

The area worked was about 23° 45′ N. Lat. and 94° 0′ E. Long.; it is actually that part of the Chin Hills at present included in the

Upper Chindwin forest division. The Northern boundary is Manipur, the Western the main chain of the Chin Hills, the Southern the main watershed of the Nankathit Chaung, and the Eastern, the upper Chindwin Civil District, in all an area some 30 miles square. The country consists of steep hills rising up to nearly 7,000′ with deep valleys (down to 2,000′ or 1,500′) between. The hills are covered with jungle, mostly of a scrubby nature (oaks, chestnuts, rhododendrons, and tree heather with an undergrowth of bracken, raspberry, etc.) mixed with patches, occasionally big, of dense evergreen jungle which are especially noticeable along the main Western ridge. There are also a few areas covered with an open growth of pine. Close to villages, "Pônzôs" of all ages occur; these are patches cleared for shifting cultivation and abandoned after one or more years. They are dense thickets of small trees of varying ages, elephant grass, grass, and weeds. The streams are all perennial, rocky, swift, and liable to sudden floods, and the valleys near them are generally covered with dense evergreen or semi-evergreen jungle, replaced higher up by bamboos and undergrowth with a few big trees, the higher parts being oak scrub. One area deserving special notice is a wind trap, through which the main road to Tiddim and Fallam passes. It is said by the Chins never to be without a wind; when an ordinary breeze is blowing in other places, a gale is blowing here and when there is a gale elsewhere, it is impossible to stand. Consequently there are no trees, nothing in fact but short grass, and one or two juniper-like shrubs, although the jungle round is rather fine. I was unable to get to it in 1915, owing to fever, and so could not verify the previous year's identifications which had been made in a hurry, without shooting birds. The area is about 2 miles long, and from a quarter to half a mile across.

The measurements given are in inches and decimals.

[*Note.*—As Mr. Hopwood is on leave, I am writing these notes out here. He has seen a rough copy, and made additions and corrections; but in re-writing I have occasionally used the first person, which is however intended to always include both of us unless the context shows the contrary.—D. M.]

1. The Jungle Crow—*Corvus macrorhynchus.* (4)

Not common.

2. Indian House-Crow—*Corvus splendens.* (8)

3. Red-billed Blue Magpie—*Urocissa occipitalis.* (12)

Foothills only as a rule. Obtained one nest in 1914, on the Manipur boundary at 3,500′.

4. Green Magpie—*Cissa chinensis.* (14)

Nest and eggs of the usual type found at 3,000′ on 7th May 1913, 12th May 1913 and 21st April 1914. Shot a bird only in 1915.

5. Indian Tree-pie—*Dendrocitta rufa.* (16)

Foothills only. Nest with 6 eggs on 5th May 1913 and 2 nests on 20th April 1915 in the plains at the foot of the hills.

6. Himalayan Tree-pie—*Dendrocitta himalayensis.* (18)

Very common at about 4,000′. We both got nice series of eggs at dates varying from April 20th to May 16th. The normal clutch was, I think, 4, but several nests, containing 3 hard set eggs only, were found.

7. Indo-Chinese Jay—*Garrulus oatesi.* (26*a*)

This rare bird was found in moderate numbers. We took 9 nests in 1915 and others in 1913 and 1914, the records of which are as follows :—

14th May 1913, C/3., Hard set.
28th April 1914, C/1., Fresh.
30th April 1914, C/3., Fresh.
29th April 1915, C/4., Set.
29th April 1915, C/4., Fresh.
22nd April 1915, C/5., Set.
1st May 1915, C/3., Set.
27th April 1915, C/4., 3 young birds, and one addled egg.
24th April 1915, C/3., Fresh.
29th April 1915, C/4., Set.
27th April 1915, C/4., Fresh.
27th April 1915, C/4., Very hard set.

It seems that the usual time for nesting is April, but a few nests may be taken on into May.

The bird is a very wily customer, and shy, and it was only with the greatest difficulty that I was able to shoot one off the nest. We failed in 1913. In 1914 the single egg taken on 28th April 1914, was found on 25th April 1914, and we spent many a cramp-stricken hour trying for the bird which would not come in shot; eventually we had to take the egg, as we were moving camp. However in 1915, I got 2 birds off the nest, and one was trapped on the nest by a Chin. Owing to the bad weather, the skins came down in a terrible state.

The eggs were of the usual garruline type and show the usual amount of variation, but the birds do not seem to build in colonies as *G. leucotis* does at Maymyo, and the nests are placed somewhat higher above the ground. One of my clutches has a very light sage green background thickly speckled equally all over with sage-green, with underlying markings of a fainter greenish grey, and some gloss. One or two dark brown hair streaks on the large end. In this clutch only one egg has traces of a ring, but generally a ring or cap is distinctly visible at the large end. The shape is a pointed oval with the big end rather more inclined to be pointed than usual. Texture, rough ; grain coarse to normal ; the shell of normal thickness, strong, fairly hard and opaque ; surface slightly pitted.

In another clutch, the colour is rather brownish, and the markings are all more numerous at the large end. A third has a brownish white back ground with browny-green spots (almost olive green); a fourth clutch is mottled with lolive, the superficial markings being few.

There are almost always dark brown hair like streaks on the eggs when found, but these wash off in blowing unless great care is taken. The streaks are very irregular and generally look like the track of an inky fly; they are like the forked lightning of tradition in shape, and may be as much as an inch in length; they are up to 1/50 of an inch broad.

I think the normal clutch is 4, but I have found 5, and have several times taken 3 hard set eggs.

The nest is a shallow saucer, in a low tree, made of roots with sometimes a very little moss outside. Externally, it measures 6″ × 2¾″, with the hollow 4½″ × 2″. It is placed at some little distance from the ground (10 to 15 feet) in fairly open jungle; in spite of this, it is well concealed and not at all easy to 'spot'.

The bird was first shot in the Kabaw Valley by Thomson of the Forest Department and sent to Oates for identification. Since then, it has been shot by the late Col. Harington and by both of us in the Kabaw Valley, in the Upper Chindwin district, and by me on the hills lying on the East of the Kabaw Valley at 2,500′, in all cases in the cold weather. It is by no means rare in the area now under discussion in April-May-June, but is said by the Chins to be much less common, or absent altogether in winter. I believe the bird has never been seen in the Kabaw Valley in the hot weather, and its nest has never been found except in the Chin Hills, always at of 4,000′ to 6,000′. This seems to be a case of partial migration from the low valleys to the hills for breeding purposes such as has been noted in other jays, and might be expected in this bird.

The average size of 28 eggs is 1·19″ × ·90″, the length varying from 1·05″ to 1·32″, and the breadth from ·85″ to ·93″.

8. Indian Grey Tit—*Parus atriceps.* (31)

Shot a bird on the Burma boundary at 2,000′.

9. Green-backed Tit—*Parus monticola.* (34)

Fairly common.

10. Hume's Red-headed Tit—*Ægithaliscus manipurensis.* (36)

Two nests, each containing 3 eggs, with parent birds brought in on 25th April 1914 (Fresh) and 12th May 1913 (Hard set). Four nests in 1915, all of the same type. They were beautifully made little structures, hanging from a twig, twice in dense, and twice in open jungle. They were made of the finest stems of grass (*i.e.* that part attaching the seed to the main stem "grass-seed stems") plastered all over with cobwebs, lichens, moss, fragments of grass, and leaves, feathers, etc., with a thick and wonderfully soft lining of feathers. The whole thing, when crushed, springs back to its original shape like a sponge. The bird appears to have a penchant for bright feathers for the lining (minivets, jungle fowl, *Phasianus humiæ*, etc.) which may be due to a desire for a bright and cheerful internal decoration scheme, but which I think is probably due to their being easier to find.

The average size of 8 eggs is ·52″ × ·41″, length from ·51″ to ·55″ and breadth from ·40″ to ·42″. The particulars of 5 clutches are:—25th April 1915, c/4, Set; 22nd April 1915, c/5, Hard set; 6th May 1915, c/4, Fresh; 12th May 1913, c/3, Set; 25th April 1914, c/3, Fresh. The usual time appears to be April, the normal clutch 3 to 5. The eggs are exceedingly fragile and white with a faint purplish ring round the large end. I have one egg showing a distinct ring of reddish purple speckles overlying a sub-surface clouded ring of faint purple. In this egg there are one or two speckles scattered over the rest of the egg, but in my others the marking is confined to the ring, which is a faint purple; and there are one or two speckles on the ring of reddish purple (faint). One egg has only a very faint, clouded, discontinuous ring, almost invisible. The ordinary egg is white with a faint clouded purplish ring at the large end on which may be a few distinct speckles of reddish purple. The gloss is only very slight.

11. Black-spotted Yellow Tit—*Machlolophus spilonotus*. (41).

Shot several birds, and found 3 nests containing 9 eggs. As they were all hard set and I found a nest with young, this bird probably breeds early in April. Average size of 7 eggs, ·73″ × ·54″, length from ·70″ to ·75″, breadth from ·52″ to ·56″. Nest and eggs both of the usual tit type.

12. Austen's Crow-Tit—*Paradoxornis guttaticollis*. (52).

Two birds, with nests; each contained one fresh egg, ·92″ × ·64″ and ·87″ × ·65″ in 1915. Nests typical: 3 nests, containing 2 eggs each in 1914.

13. *Suthora* subsp. nov.

Close to *Suthora poliotis ripponi*. It has not yet been described for want of more specimens. A single specimen, noted by Harington in his notes on the *Timeliides*, was obtained in May 1913. It was snared by a Chin, and we never saw another specimen, though we tried hard for more in 1914 and 1915. The nest was not procured.

14. Hoary-headed Crow-Tit—*Scæorhynchus gularis*. (61).

(*Psittiparus gularis transflavialis*) nests and eggs. Nests resemble those of *P. guttaticollis* but the eggs are very different, being less fragile, and blotched pretty well all over with greyish and yellowish brown. The eggs measure about 0·78″ × 0·62″. Dates as follows:—C/2 26th April 1914, c/2 28th April 1914, c/2 29th April 1914, c/2 1st May 1914, c/3 4th May 1914, c/2 4th May 1914, and two young birds, fully fledged, about the same date Several more nests in 1915.

15. Rufous-necked Laughing-Thrush—*Dryonastes ruficollis*. (62).

Nest 1914 at 2,000′. Foothills only.

16. Austen's Laughing-Thrush—*Dryonastes galbanus*. (68).

Fairly common at about 5,000′, but appears to be local. Mr. E. C. Stuart-Baker quotes Hopwood as saying that the nest and eggs resemble those of *D. ruficollis*. The nest certainly does, but none of the eggs actually taken by either of us had the slightest trace of blue. Mr. Stuart-Baker has a blue clutch. ("practically indistinguishable from the eggs of *D. ruficollis*"), and several nests of *D. galbanus* containing blue eggs were brought in to me, in 1915; but I never got the bird off a blue clutch, and these eggs may have been substituted by the finders. Mr. Stuart-Baker's blue clutch shows that the bird may lay blue or white eggs, in the same manner as *D. sannio.*

The nest is generally built in the fork of a low bush or shrub, 2′ to 10′ high, in fairly open jungle, and is not difficult to see. Outside it is roughly made of grass-stems with the ends left sticking out untidily in all directions and is lined with yellow grass seed stems; in shape it is a large flattish cup, and there are often a few moss roots, and small twigs mixed with the main structure of the nest (but not with the lining). The general effect is a brown outside, lined yellow, as opposed to *I. cineracea* of which the nest is brown outside, lined black.

The eggs number 2 or 3 in a clutch (I only once found 4) and those of which we are sure were white, but there may be blue eggs as well. They are glossy, and of a satiny texture, but this, as well as the gloss, varies considerably. The shell is of medium thickness, fairly hard, and opaque, the grain is normal to fine; the surface is sometimes smooth, sometimes closely and minutely pitted. The average size of 45 eggs is 1·02″ × ·73″, length varying from ·93″ to 1·09″ and the breadth from ·70″ to ·79″. In shape, they are typically rather pointed, the large end being roundish, and the small end tapering considerably. The eggs appear liable to a good deal of variation in all respects, and begin to be laid about May; we only found a few in April.

17. Himalayan White-Crested Laughing-Thrush—*Garrulax leucolophus leucolophus.* (69).

Common.

18. Black-gorgetted Laughing-Thrush—*Garrulax pectoralis.* (72).

Common.

19. Necklaced Laughing-Thrush—*Garrulax moniliger.* (73).

The above 3 species inhabit the bamboo jungle in the valleys.

20. McClelland's Laughing-Thrush—*Garrulax gularis.* (74).

I shot a bird which I identified as this in 1915, but the skin was very badly smashed up, and I am doubtful.

21. Ashy Laughing-Thrush—*Ianthocincla cineracea.* (79).

This is the common laughing thrush of the district, being exceedingly abundant between 4,000′ and 6,000′, and breeding in the raspberry canes and thickets near the villages. We obtained a large number of nests and eggs at the end of April, and beginning of May. The laying season seems to extend for about a month, as we got both hard set and fresh eggs almost every day. The earliest incubated eggs were found on April 20th; this is different from *D. galbanus,* which does not begin to breed till about the beginning of May. (My earliest eggs were a fresh clutch on 27th April 1915.)

The nest is a small and flimsy copy of that of *G. pectoralis,* and is generally fairly conspicuous; the bird obliges by sitting on it until you almost touch her, thereby rendering identification easy. The nests were generally placed in low thickish bushes, 3′ to 6′ high, and made of grass stems and fine twigs, not very tidily put together, as all the ends stick out. The lining is of fine black and brown stems and a few moss roots, (see *D. galbanus*). In shape, a hollow saucer, about 4½″ across and 2″ deep externally, and 3″ × 1½ internally. Except for the lining, the nest and situation are very similar to those of *D. galbanus*. Both birds breed fairly high up, at altitudes of 3,000′ and over.

In shape and colour, the eggs are very like those of *T. virgatum*, and *T. lineatum*, being a little smaller *on the whole*. The average size of 59 eggs is 1·01″ × ·74″, the length varying from ·91″ to 1·08″ and the breadth from ·69″ to ·79″. I have one egg which is 1·15″ long, which is not included above, as it may possibly belong to a cuckoo.

22. Hume's Chestnut-headed Laughing-Thrush—*Trochalopterum erythrolæma*. (83). (*T. erythrocephalum erythrolæma*).

Secured 7 nests, containing 12 eggs in 1915, mostly at the end of April. I am not quite certain what to make of this bird's eggs and nests. Hopwood got his first nest on 12th May 1913. " With parent bird, in bamboo scrub on the extreme summit of a hill, at about 6,000′; the nest was a massive cup of moss lined with roots, and was placed in a small very thick ever green shrub about 4′ from the ground." Subsequently, in 1915, I came to the conclusion that the nest was generally placed 4′ to 8′ from the ground, and is—at times at least easily visible. They are massive deep cups of grass stems and twigs lined with fine twigs, moss roots, and roots fairly loosely put together. Some of the eggs are of a peculiar elongated shape, more or less elliptical; others are shorter. In my own series, the ground colour was bright blue marked with dark blotches, spots, and streaks varying from dark purplish brown to black in colour, and in size from 0·1″ in diameter to mere specks. In one or two eggs, the spots are numerous round the large end, in another, there are only about a dozen small specks; the usual type is intermediate, *i.e.*, a few markings of various sizes scattered over the large end, and only one or two on the small end. Again, I have some eggs in which the surface is almost chalky, and rough, with very little gloss; I think these must be due to immature hens; the typical egg is glossy, with a satiny texture, giving the appearance of the background of a wedgewood plaque. The shell is rather soft, and thickish, and the grain normal.

Average size of 14 eggs is 1·20″ × ·80″. This is I think due to the elongated eggs mentioned above. I think a more normal size would be say 1·20″ × ·83″. The length varies from 1·10″ to 1·30″ and the breadth from 72″ to ·85″. They are generally less broad than those of *T. chrysopterum*, and *T. erythrocephalum* which I have in my collection, but in this connection, I think all the measurements of eggs seem smaller in the Chin Hills than in Cachar, and Assam.

23. Assam Crimson-winged Laughing-Thrush— *Trochalopterum phœniceum bakeri*. (87 *a*).

Obtained nests in all 3 years, the clutch being either 2 or 3 (generally the former). The nests were generally placed in bamboos, and nests and eggs were precisely similar to typical *T. phœniceum.*

24. Manipur Streaked Laughing-Thrush—*Trochalopterum virgatum.* (98).

Moderately common: breeds a little later than *I. cineracea*; *i.e.*, the first incubated eggs I got were in May 2nd. The nest is generally built in thick bushes in open jungle, or in the grass round the base of a bush. It is a neat structure made of grass and bamboo leaves outside, then a few ordinary tree leaves (dry) and creeper stems, lined with fine grass and rootlets. It is generally very thick at the bottom. The eggs are indistinguishable from those of *T. lineatum.* Average size of 22 eggs 1·03″ × ·75″, length varying from ·95″ to 1·12″, and the breadth from ·72″ to ·79″.

25. Austen's Striated Laughing-Thrush—*Grammatoptila striata austeni.* (102).

Nest with 3 fresh eggs on 29th April 1914. Both nest and eggs very similar to those of *G. pectoralis.*

26. Spotted-breasted Laughing-Thrush—*Stactocichla merulina.* (103).

Nest with 2 eggs and parent bird on 27th April 1914; as described in Harington's notes.

27. Grant's Scimitar Babbler—*Pomatorhinus schisticeps mearsi.* (116 *a*).

Only found in the foot hills.

28. Phayre's Scimitar Babbler—*Pomatorhinus ferruginosus phaynii.* (24).

The birds are not uncommon, and one or two nests were obtained. c/3., Fresh, 24th April 1914. c/3., Hard set, 10th May 1915.

29. Baker's Rufous-necked Scimitar Babbler—*Pomatorhinus ruficollis bakeri.* (125).

Fairly common. Took eggs in 1913 and 1914 but none in 1915.

30. McClelland's Scimitar Babbler—*Pomatorhinus erythrogenus macclellandi.* (130).

Extremely common. Normal clutch, 3.

31. Burmese Spotted Babbler—*Pellorneum ruficepsminus.* (143).

Foothills.

32. Rippon's Babbler—*Pellorneum ignotum cinnamomeum.* (148 *a*).

Occurs, not rare. The nest is generally in the lowest branches of a thickish bush 1′ to 4′ high, being worked in with the grass around, if there is any. I found one nest on the ground built into the roots of a tree, from which the soil had been washed away. The nest is built of grass on a foundation of bamboo leaves with a lining of moss roots, and is nearly always domed, often very slightly. The eggs number 2 to 4, generally 3, and are reddish white, freckled all over with red-brown markings generally to form a cap, or ring round the large end. In shape, they are generally ovals, with bluntish ends. The gloss varies, but the eggs are generally fairly glossy. The average size of 22 eggs is ·80″ × ·59″, length from ·73″ to ·84″, and breadth from ·57″ to ·62″.

33. Tickell's Babbler—*Drymocataphus tickelli.* (151).

Found nests and eggs which were referred to this species by Mr. E. C. Stuart-Baker.

34. Nepalese Babbler—*Alcippe nepalensis.* (163).

Common at the higher levels. It is replaced lower down by

35. The Burmese Babbler—*Alcippe phæocephala phayrii.* (165).

Nest, eggs and birds of both species were obtained.

36. Assam Black-throated Babbler—*Stachyris nigriceps coltarti.* (169 *a*).

Shot one bird. Apparently not common.

37. Hume's Babbler—*Stachyrhidopsis nigrifrons.* (173).

Obtained one clutch of eggs referred to this species, but did not get the bird.

38. Yellow-breasted Babbler—*Mixornis rubricapillus.* (176).

A bird shot in 1913.

39. Assam Tit-Babbler—*Schœniparus dubius mandellii.* (179).

Very common.

40. *Myiophoneus*, sp.

Identified it as *eugenii* in a hurry; according to Oates, F.B.I., it should be *temmincki*; probably intermediate. Fairly common along all streams. 7 eggs average 1·31″ × ·96″.

41. Grey Sibia—*Lioptila gracilis.* (205).

Occurs at the highest levels, generally in pine forest. It is said by the Chin, who is a very nimble shot with his bow and pellets, to be one of the most difficult birds to shoot, as it runs along the branches, in and out of leaves, and keeps among thick foliage. The nest is very firm and neat, placed in a fork, generally of a pine and is made of grass stems, plastered outside with grass, leaves, cobwebs and some moss, all worked in with the green needles of the pine, and lined with grass-seed stems and rootlets. The nests were found between 1st and 5th of May, at 5,000′ to 6,500′; the eggs were fresh and numbered 2 to the clutch. There are two varieties of egg; one bluish grey, like blackbirds, and the other (the less common of the two) distinctly pinkish. The general freckled character of the markings is similar in both cases. The shell is very thin and fragile. The average size of 5 eggs is ·91″ × ·67″. Length from ·89″ to ·94″ and breadth from ·65″ to ·71″.

42. Rippon's Bar-wing—*Actinodura egertoni ripponi.* (211*b*).

Fairly common. Builds a largish nest, generally in a low bush (3′ to 8′ high) carefully made of roots and grass stems, surrounded by bamboo leaves and moss, the whole thing being nicely rounded off. There is generally some lining of fine moss roots. Clutches number 2 or 3, and the average size of 29 eggs is ·89″ × ·66″, length varying from ·80″ to ·97″ and breadth from ·60″ to ·71″.

43. Chestnut-headed Staphidia—*Staphidia castaneiceps.* (216).

The nest is generally in a hole in a bank; I have a distinct recollection of finding at least one nest in the lowest branches of a small bush, but I cannot find any record of it in my rough notes. The nest is made of moss thickly lined with bark fibre, and grass seed stems, making a neat cup. The eggs are white with a faint bluish or greenish tinge, speckled pretty well all over with fairly large brown spots, with which are mixed a few pale purple ones. The average size of 44 eggs is ·66″ × ·52″, length varying from ·60″ to ·71″ and breadth from ·50″ to ·56″. I found one clutch of 4 eggs, but the usual number is 3 and sometimes 2 eggs only.

44. Stripe-throated Yuhina—*Yuhina gularis.* (223).

Shot a bird identified as this. The skin was very bad, and I was not certain about it. It was probably *Y. G. yangpiensis* (Sharpe).

45. Swinhoe's White-eye—*Zosterops simplex.* (228).

Two nests and birds. The nests were hung between 2 twigs and made of cobwebs, lichens and grass lined with grass seed stems and vegetable pappus. It is very flimsy and small, but seems fairly tough.

46. Yellow-naped Ixulus—*Ixulus flavicollis flavicollis.* (232).

Nest, (1) on the ground, in the roots of a tree, (2) a cradle-like arrangement, hung between 2 twigs. The one on the ground was a well made cup of moss, lined with moss roots. I found a clutch of 2 eggs hard set on April 29th. Six eggs average ·75″ × ·56″, length varying from ·73″ to ·77″ and breadth from ·55″ to ·58″.

47. Red-billed Liothrix—*Liothrix lutia callipygus.* (235).

Nests and eggs.

48. Nepalese Cutia—*Cutia nepalensis.* (236).

Common. Saw a couple of birds collecting moss on May 16th, 1913, but failed to get eggs.

49. Red-winged Shrike-Tit—*Pteruthius erythropterus.* (237).

Common. Did not find nest.

50. Chestnut-throated Shrike-Tit—*Pteruthius melanotis.* (239).

Got two clutches of this; c/2, 25th April 1914; and c/3, May 1914.

51. The Common Iora—*Ægithina tiphia.* (243).

Common. Failed to get nests and eggs.

52. Orange-bellied Chloropsis—*Chloropsis hardwickii.* (249).

Obtained birds and nests; all the eggs were broken.

53. Sultan bird—*Melanochlora sultanea.* (253).

Seen at Madan, 1913. Shot a bird from a flock at 3,500′ in 1915.

54. Silver-eared Mesia—*Mesia argentauris.* (257).

Several nests and eggs in all years.

55. Burmese White-throated Bulbul—*Criniger burmanicus.* (264).

One nest found, but the eggs were on the point of hatching, and could not be preserved.

56. Himalayan Black Bulbul—*Hypsipites psaroides.* (269).

Common. Nests and eggs.

57. Rufous-bellied bulbul—*Hemixus macclellandi.* (275).

Nest, with 2 eggs, found in June, 1913, and in other years.

58. Burmese Red-vented Bulbul—*Molpastes burmanicus.* (279).

Very common.

59. Blyth's Bulbul—*Xanthixus flavescens.* (287).

Common. Took several nests.

60. Black-crested Yellow Bulbul—*Otocompsa flaviventris.* (290).

Very common. Numerous nests at about 2,000′.

61. Finch-billed Bulbul—*Spizixus canifrons.* (292).

Fairly common. The nest always appears to be made of corkscrewlike tendrils of some vine which are plaited together to form a shallow saucer. There is no lining, or only traces of fluff or grass. It generally builds in scrub jungle 8′ or 10′ high. The first nest was found on the extreme top of the local mountain at Haingyan (6,300′). Size of the eggs, about 1·01″ × ·68″.

62. Cinnamon-bellied Nuthatch—*Sitta cinnamomeiventris.* (316).

Shot one at 1,000′.

63. Beautiful Nuthatch—*Sitta formosa.* (324).

Three nuthatch eggs were brought in to me by a Chin. measuring ·76″, ·79″ and ·78″ by ·55″, ·54″, ·54″ with the shattered remnants of a bird, which I think was this.

64. Velvet-fronted Blue Nuthatch—*Sitta frontalis.* (325).

Not rare at 3,000′ and over. Nest and eggs in 1915. c/3, measuring ·64″ × ·52″, 24th April 1915. Nest with young in a small hollow tree, 9th May 1913. The birds were entering through a hole made by a chopper.

65. Black Drongo—*Dicrurus ater.* (327).

Common.

66. Grey Drongo—*Dicrurus cineraceus.* (333).

Common.

67. Bronzed Drongo—*Chaptia ænea.* (334).

Not common. Nests and eggs taken.

68. Hair-crested Drongo—*Chibia hottentotta.* (335).

Common.

69. Lesser Racket-tailed Drongo—*Bhringa remifer.* (339).

Very common. The birds nest very low down here, often in a fork of a bamboo within reach of the hand.

70. Mt. Victoria Tree-Creeper—*Certhia victoriæ.* (344*a*).

Shot a bird, identified as this by the late Col. Harington, in the south of the area, and another identified by us in 1914 as the next species in the North.

71. Hume's Tree-Creeper—*Certhia manipurensis.* (345).

Shot off the nest a bird identified as this, in the extreme north of the area. Probably in this area, the forms are intermediate, approaching *C. manipurensis* in the north, and *C. victoriæ* in the south. The bird identified by us as *C. manipurensis* was shot on the Chin Hills—Manipur boundary, (actually, I think about 2 yards inside Manipur). We obtained 2 nests with eggs of this bird, the eggs being of the ordinary type, and measuring ·67″, and ·69″ × ·50″. c/3, slightly set, 29th April 1914 and c/4 1st May 1915 (one egg broken), measuring ·64″, ·64″, ·64′ × ·45″, ·45″ and ·47″. The nests were in both cases pads of fibres, moss, and a few roots, with a feather or two in the lining, not large, and scarcely hollowed out at all in the centre, placed in holes in small trees, at 8′ and 10′ high. Elevation 6,000′.

72. Mt. Victoria Wren—*Urocichla oatesi.* (355 *b*).

Eggs and nest, c/3, hard set, on 5th May 1914.

73. Indian Tailor Bird—*Orthotomus sutorius.* (374).

Nest, and bird, at 2,500′.

74. Franklin's Wren-Warbler—*Franklinia gracilis.* (382).

75. Beavan's Wren-Warbler—*Franklinia rufecens.* (383).

76. Tenasserim White-tailed Willow-Warbler—*Acanthopneuste davisoni.* (430).

Got a bird which I think was this and several moss nests containing tiny white eggs which I think must belong to it.

77. Yellow-bellied Flycatcher-Warbler—*Abrornis superciliaris.* (440).

A nest with 4 eggs, taken from a hole in a bamboo brought in with the parent bird in 1913.

78. Swinhoe's Reed-Warbler—*Urosphena squamiceps.* (457).

I shot a single specimen of this in December 1914, in thick jungle, playing about among the rocks in a small chaung forming the Burma Chin Hills boundary.

79. Brown Hill-Warbler—*Suya crinigera.* (458).

80. Austen's Hill-Warbler—*Suya khasiana.* (460).

81. Anderson's Hill-Warbler—*Suya superciliaris.* (461).

Nests of all these obtained. Numerous other small warblers were seen, which were not identified.

82. Indian Wren-Warbler—*Prinia inornata.* (466).

Shot a single specimen on low ground in March 1915.

83. Burmese Shrike—*Lanius collurioides.* (474).

Nests and eggs.

84. Black-headed Shrike—*Lanius nigriceps.* (475).

Nests and eggs.

85. Brown-Shrike—*Lanius cristatus.* (481).

Fairly common. One nest and eggs.

86. Nepalese Wood-Shrike—*Tephrodornis pelvicus.* (486).

Shot a bird.

87. Burmese Scarlet Minivet—*Pericrocotus fraterculus.* (491).

88. Rosy Minivet—*Pericrocotus roseus.* (499).

89. Small Minivet—*Pericrocotus peregrinus.* (500).

90. Dark-grey Cuckoo-Shrike—*Campophaga melanoschista.* (505).

Found 2 nests with young, (May, 1913) and so did not shoot the parent birds.

91. Black-headed Cuckoo-Shrike—*Campophaga sykesi.* (508).

Shot a bird, low down.

92. Large Cuckoo-Shrike—*Graucalus macii.* (510).

Common.

93. Ashy Swallow-Shrike—*Artamus fuscus.* (512).

Common in clearings.

The Chins call this bird 'Pyalpya' which is their general name for swallows, martins and swifts.

94. Burmese Black-naped Oriole—*Oriolus tenuirostris.* (515).

Shot a bird at 3,000′.

95. Maroon Oriole—*Oriolus trailii.* (522).

Common. Got nests and eggs, exactly resembling those of the Common Oriole.

96. Indian Grackle—*Eulabes intermedia.* (524).

97. Grey-headed Myna—*Sturnia malabarica.* (538).

98. *Graculipica* sp. ?

I believe it is *burmanica.*

99. Common Myna—*Acridotheres tristis.* (549).

Mynas occur, but are not common.

100. Sooty Flycatcher—*Hemichelidon sibirica.* (558).

101. Little Pied Flycatcher—*Cyornis melanoleucus.* (569).

A nest brought in with this bird, containing 4 eggs, measuring ·66″ × ·54″, of the same type as *C. rubeculoides* and *C. superciliaris.* Shot 2 or 3 birds, but did not manage to find a nest myself.

102. Blue-throated Flycatcher—*Cyornis rubeculoides.* (575).

Common.

103. Verditer Flycatcher—*Stoparola melanops.* (579).

Fairly common.

104. Sharpe's White-gorgeted Flycatcher—*Anthipes leucops.* (584).

A bird brought with a nest, a very deep cup, placed in the grass growing from holes in a tree stump. Nest made of grass, leaves, and a little moss lined with fine grass fibres, a few bamboo leaves, and skeleton leaves being worked into the outside. The eggs were ·69″ × ·53″, and were white, spotted with reddish brown.

105. Grey-headed Flycatcher—*Culicicapa ceylonensis.* (592).

106. Large Niltava—*Niltava grandis.* (593).

107. Burmese Paradise Flycatcher—*Terpsiphone affinis.* (599).

A nest and bird from the Chin Hills—Manipur boundary.

108. Indian Black-naped Flycatcher—*Hypothymis azurea.* (601).

109. White-browed Fantail Flycatcher—*Rhipidura albifrontata.* (604).

Shot a bird low down. It changes higher up into the next species.

110. White-throated Fantail Flycatcher—*Rhipidura albicollis.* (605).

111. Common Pied Bush-Chat—*Pratincola caprata.* (608).

112. Harington's Bush-Chat—*Oreicola ferrea haringtoni.* (615 *a*).

Not uncommon. The nest is built in a bank, often along a path, and is large for the size of the bird. It is a deep cup, made of moss, grass and grass roots, or of moss only, lined with fine grass bark-fibre, roots, and often goat's hair (or in one nest only, fine yellowish roots only). The sides and bottom of the nest are thick, and in two cases the nest was made entirely of moss. This was the only nest found in which hair was much used. The eggs are pale blue—almost "hedge-sparrow" blue—and have a series of faint reddish markings (spots, or speckles) round the large end of the eggs. These vary greatly, in some cases forming a distinct ring (in 2 eggs a cap) and in others being only seen with difficulty; in a few eggs, and in one whole clutch, they were entirely absent. Clutches generally numbered 4 or 5, but in one case I found 3 hard set eggs. Average size of 43 eggs is ·72″ × ·56. Length from ·67″ to ·78″, and the breadth from ·53″ to ·58.

113. Eastern Spotted Forktail—*Henicurus guttatus.* (631).

114. Slaty-backed Forktail.—*Henicurus schistaceus.* (632).

115. White-capped Redstart—*Chimarrhornis leucocephalus.* (638).

116. Magpie Robin—*Copsychus saularis.* (663).

117. Black-busted Ouzel—*Merula protomomelæna.* (679).

Fairly common. The eggs and nests of the usual meruline type, the nest being made of moss lined with roots, and placed in a fork at no great height from the ground, or actually on the ground itself.

118. Orange-headed Ground-Thrush—*Geocichla citrina.* (686).

119. Chestnut-bellied Rock-Thrush—*Petrophila erythrogastra.* (690).

Shot a single specimen on the boundary in March.

120. *Zoothera* sp.?

Seen on the road. Could not identify it further.

121. *Cinclus* sp.?

Seen in the Nanpalaw stream.

122. Chestnut-bellied Munia—*Munia atricapilla.* (726).

123. Hodgson's Munia—*Uroloncha acuticaudata.* (727).

124. Cinnamon Tree-Sparrow—*Passer cinnamomeus.* (780).

125. Indian Sand-Martin—*Cotile sinensis.* (809).

Seen in streams at low levels.

126. Syke's Striated Swallow—*Hirundo erythropygia.* (823).

127. *Anthus* sp.?

I think it was *striolatus.*

128. *Alauda gulgula* ?

These two species, of whose identification I am doubtful, were seen especially in the wind trap.

129. Larger Streaked Spider-hunter—*Arachnothera magna.* (906).

Two or 3 nests and birds.

130. Fire-breasted Flower-pecker—*Dicæum ignipectus.* (915).

Shot 1915.

131. Green-breasted Pitta.—*Pitta cucullata.* (935).

A clutch of 3 eggs and the parent bird brought in by a Chin in June 1913.

132. Gould's Broadbill—*Serilophus lunatus.* (942).

133. Hodgson's Broadbill—*Serilophus rubripygius.* (943).

134. Long-tailed Broadbill—*Psarisomus dalhousiæ.* (944).

135. Black-naped Green Woodpecker—*Gecinus occipitalis.* (950).

136. Small Himalayan Yellow-naped Woodpecker—*Gecinus chlorolophus* (951).

137. Northern Pale-headed Woodpecker—*Gecinulus grantia.* (958).

138. Rufous-bellied Pied Woodpecker—*Hypopicus hyperythrus.* (960).

I am not quite satisfied with this identification, but think it is correct.

139. Stripe-breasted Pied Woodpecker—*Dendrocopus atratus.* (968).

140. Great Slaty Woodpecker—*Hemilophus pulverulentus.* (996).

141. Rufous Piculet—*Sasia ochracea.* (1002).

142. Great Himalayan Barbet—*Megalæma marshallorum.* (1006).

143. Lineated Barbet—*Thereiceryx lineatus.* (1009).

144. Blue-throated Barbet—*Cyanops asiatica.* (1012).

145. Golden-throated Barbet—*Cyanops franklini.* (1017).

Nest and eggs, 1915.

146. Crimson-breasted Barbet—*Xantholæma hæmatocephala.* (1019).

147. Burmese Roller—*Coracias affinis.* (1023).

148. Broad-billed Roller—*Eurystomus orientalis.* (1025).

149. Common Indian Bee-eater—*Merops viridis.* (1026).

This and the next 3 species all seen in a deep valley.

150. Blue-tailed Bee-eater—*Merops philippinus.* (1027).

151. Chestnut-headed Bee-eater—*Melittophagus swinhoii.* (1030).

152. Blue-bearded Bee-eater—*Nyctiornis athertoni.* (1031).

Nest and young, 1913. Nest and eggs, 1915.

153. Indian Pied Kingfisher—*Ceryle varia.* (1033).

154. Himalayan Pied Kingfisher. *Ceryle lugubris.* (1034).

I saw a large pied king-fisher, which I think must have been this.

155. Common Kingfisher—*Alcedo ispida.* (1035).

156. Blyth's Kingfisher—*Alcedo grandis.* (1038).

An *Alcedo* seen in the Nampalaw stream, not *A. ispida* Identification not certain.

157. Brown-headed Stork-billed Kingfisher—*Pelargopsis gurial.* (1043).

158. White-breasted Kingfisher—*Halcyon smyrnensis.* (1044).

159. Great Hornbill—*Dichoceros bicornis.* (1051).

160. Indo-Burmese Pied Hornbill—*Anthracoceros albirostris.* (1053).

161. Malayan Wreathed Hornbill—*Rhytidoceros undulatus.* (1054).

All these are common. They are valued by the Chins, as their feathers are much used both as ceremonial head dresses (as are the tail feathers of racket-tailed drongos) and for hanging round graves. The hornbill is the only bird of killing which a record is put on the grave; that is, the custom is to cut into a teak plank or stone used as the head piece of the grave an image of all beasts killed by the tenant (including things from men and elephants to barking deer), but hornbills are the only birds so recorded. They are shot from a platform in a ficus-bound tree, with a bow and arrow, when they come to feed.

162. Indian Hoopoe—*Upupa indica.* (1067).

163. Brown-necked Spine-tail—*Chætura indica.* (?) (1078).

I saw a flock one day which I think was this.

164. Common Indian Nightjar—*Caprimulgus asiaticus.* (1091).

165. Horsfield's Nightjar—*Caprimulgus macrurus.* (1093).

166. Chinese Nightjar—*Caprimulgus jotaka.* (1095 *a*).

Two hard set eggs taken at Haingyan, which were unfortunately broken.

167. Great Eared Nightjar—*Lyncornis cerviniceps.* (1096).

Saw this bird in the Chin Hills and took two eggs (both single) in the Upper Chindwin Division. They were found in 'Tin-wa' (*Cephalostachyum pergracile*) bamboo jungle, one on 2nd April 1914, very hard set, and measuring 1·69″×1·18″, the egg being an oval slightly pointed at one end, and the other on 15th April 1915, Fresh, a perfect oval measuring 1·66″×1·17″. In neither case was there any nest, and the eggs were of the usual nightjar type.

168. Hodgson's Frogmouth—*Batrachostomus hodgsoni.* (1097).

Six or seven nests brought in, one with young birds, four or five with eggs, and the rest empty. Typical of the species.

169. Red-headed Trogon—*Harpactes erythrocephalus.* (1101).

170. Red-rumped Trogon—*Harpactes duvauceli.* (1102).

Hopwood saw one in 1913, but was unfortunate in missing it. It was either this, or some species not included in F. B. I., as it was not *fasciatus, erythrocephalus* or *oresciuus.*

171. Cuckoo—*Cuculus canorus.* (1104).

Common.

Took eggs from nests of *M. argentauris*, pale blue and measuring ·92″×·71″, and ·88″×·69″.

172. Himalayan Cuckoo—*Cuculus saturatus.* (1105).

I took two eggs from nests of (?) *A. davisoni* which are exactly like those which this bird lays, but did not shoot a bird.

173. Large Hawk-Cuckoo—*Hierococcyx sparverioides.* (1108).

Common. I took eggs of this bird as follows :—

(1) Ex. 130 (*P. macclellandi*) longish in shape; light blue, 1·29″×·83″. Fresh, 24th April 1914; 3 eggs of *P. maclellandi.*

(2) Ex. 79. (*I. cineracca*) rather more obtuse and darker than (1), Slightly set, 1·27″ × ·85″. 2 eggs of *I. cineracca,* 28th April 1915.

(3) Ex. 130. Hard set; shape as (2) but darker blue. 1·26″×·84″ 2 eggs of No. 130, 28th April 1914.

(4) Ex. 130. Like (1) 1·26″×·82″, one egg of *P. maclellandi,* 24th April 1915.

(5) Ex. 79. Hard set. Very obtuse. Colour between (1) and (2), 1·28″×·88″. 2 eggs of No. 79, 3rd May 1915.

In addition to these, which are in my collection, Hopwood has 3 or 4 more, of which I have not got particulars, one ex. *G. pectoralis,* one ex. 79, and one ex. 130. A young bird was obtained in 1914 in the nest of *M. argentauris*; and a bird was seen to get up off the path with something in its mouth; I think it was an egg, but could not shoot the bird to make sure.

174. Common Hawk-Cuckoo—*Hierococcyx varius.* (1109).

Two eggs, both from the nests of *I. cineracea,* the first a light, the second a deepish blue, 1·01″×·82″, and 1·02″×·80″, were referred to this species.

175. Hodgson's Hawk-Cuckoo—*Hierococcyx nisicolor.* (1110).

Two eggs from nest of *C. rubeculoides,* ·84″×·57″, and ·93″×·65″.

176. Drongo Cuckoo—*Surniculus lugubris.* (1117).

I found a nest of *B. remifer* containing 3 eggs, left it for 2 days, and sent out a man to bring it in. It then contained only two of the original eggs, and a third which I think may be that of this species, which had not been there before. It seems too big for the bird, being 1·03″×·79″, but I do not think the man sent out to bring in the nest is likely to have played any tricks and do not know what else it can be.

177. Indian Kœl—*Eudynamis honorata.* (1120).

178. Large Green-billed Malkoha—*Rhopodytes tristis.* (1123).

179. Large Burmese Paroquet—*Palæornis indoburmanicus.* (1136).

180. Rose-ringed Paroquet—*Palæornis torquatus.* (1138).

181. Burmese Slaty-headed Paroquet—*Palæornis finschi.* (1142).

182. Red-breasted Paroquet—*Palæornis fasciatus.* (1145).

183. Screech Owl—*Strix flammea.* (1152).

Heard one evening.

184. Brown Fish-Owl—*Ketupa zeylonensis.* (1164).

185. Large-Barred Owlet—*Glaucidium cuculoides.* (1183).

186. Jungle Owlet—*Glaucidium radiatum.* (1184).

Shot a bird at 1,500′ which I identified as this. It was badly smashed up.

187. Brown Hawk-Owl—*Ninox scutulata.* (1187).

188. Indian White-backed Vulture—*Pseudogyps bengalensis.* (1196).

189. Black Eagle—*Ictinaëtus malayensis.* (1210).

190. Changeable Hawk Eagle—*Spizaëtus limnaëtus.* (1212).

191. Crested Serpent Eagle—*Spilornis cheela.* (1217).

Bird off the nest, which was about half way up a 600′ hill at about 4,000′, and made of sticks with a lining of green leaves. It was placed about 30′ up in the fork of a 60′ tree, the nest contained one egg, set, 2·75″ ×2·12″. The tail and wing feathers of this, and all the big hawks and eagles are much prized by the Chins for ceremonial observances. They pay up to two annas each for them.

192. Pariah Kite—*Milvus govinda.* (1229).

193. Shikra—*Astur badius.* (1244).

194. Crested Goshawk—*Lophopizias trivirgatus.* (1246).

195. Besra Sparrow-Hawk—*Accipiter virgatus.* (1248).

196. Crested Honey-Buzzard—*Pernis critatus.* (1249).

197. Shahin Falcon—*Falco peregrinator.* (1255).

198. Red-legged Falconet—*Microhierax eutolmus.* (1267).

I saw several other hawks and eagles which I could not recognise.

199. Bengal Green Pigeon—*Crocopus phœnicopterus.* (1271).

200. Thick-billed Green Pigeon—*Treron nepalensis.* (1281).

Nest at Madan in 1913.

201. Pin-tailed Green Pigeon—*Sphenocercus apicauda.* (1282).

Several nests and birds.

202. Green Imperial Pigeon—*Carpophaga ænea.* (1284).

Shot a bird at a low elevation. The next species is found higher up.

203. Grey-headed Imperial Pigeon—*Ducula griseicapilla.* (1287).

204. Bronze-winged Dove—*Chalcophaps indica.* (1291).

205. Indian Turtle-Dove—*Turtur ferrago.* (1305).

206. Malayan Spotted Dove—*Turtur tigrinus.* (1308).

207. Bar-tailed Cuckoo-Dove—*Macropygia tusalia.* (1312).

Many nests and eggs. Nest massive for a dove, having often some moss mixed with the twigs. Only twice got two eggs or young birds in one nest, the rest were all single. Hopwood kept a bird snared off a nest for 6 months; it did very well on a diet of rice, but died in the rains.

208. Red Jungle Fowl—*Gallus ferrugineus.* (1328).

209. Mrs. Hume's Pheasant—*Phasianus humiæ.* (1331).

Eggs, with a bird skin. The eggs were of the ordinary *Phasianus* type; 3 clutches were obtained, all from about 6,500′. The bird seems to breed near the top of the main ridge. 8 eggs obtained on 1st May 1914, Hard set; 7 eggs on 1st May 1914, Hard set; 10 eggs on 1st May 1915, Hard set. The average size of 15 eggs is 1·85″ × 1·37″. Length from 1·99″ to 1·78″, and breadth from 1·31″ to 1·40″.

210. Black-breasted Kalij Pheasant—*Gennæus horsfieldi horsfieldi.* (1339).

211. Cuvier's Silver Pheasant—*Gennæus h. cuvieri.* (1340 *d*).

212. Williams's Silver Pheasant—*Gennæus h. williamsi.* (1340 *c*).

I was much puzzled by the variation in the pheasants, until I saw Mr. E. C. Stuart-Baker's paper (J. B. N. H. S., Vol. XXIII, p. 662), showing that these three sub-species all occur in a very narrow area, all three falling within the area worked by us.

213. Grey-bellied Horned Pheasant—*Tragopan blythii.* (1346).

A female snared and brought in in 1913, eggs not obtained.

214. Western Bamboo-Partridge—*Bambusicola fytchii.* (1352).

Common.

215. Arrakan Hill-Partridge—*Arboricola intermedia.* (1364).

216. White-cheeked Hill-Partridge—*Arboricola atrigularis.* (1365).

As far as I could make out, *A. intermedia* was the form in the West, *A. atrigularis* in the East. But there was a great deal of overlapping.

217. Chinese Francolin—*Francolinus chinensis.* (1374).

Eggs and bird obtained in 1914.

218. Woodcock—*Scolopax rusticola.* (1482).

Undoubtedly occurs in the winter, and might remain to breed. We found none.

219. Great White-bellied Heron—*Ardea insignis.* (1557).

Several herons, etc., were met with in the streams at the foot of the hills. This was the only one identified.

A CATALOGUE OF NEW WASPS AND BEES (*FOSSORES, DIPLOPTERA* AND *ANTHOPHILA*) DESCRIBED FROM THE INDIAN REGION SINCE 1897.

BY

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Part III.

(*Continued from page* 721 *of Volume XXIV.*)

DIPLOPTERA.

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M. maligna, Cameron, p. 133, do. do. do.
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M. studiosella, Cockerell, p. 314, A.M.N.H., VII, 1911, Simla.
M. vera, Nurse, p. 150, J.A.S.B., LXX, 1901, Deesa.
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M. monoceros, Friese, p. 358, do. do. do.
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*M. asiatica**, Morl, Nurse, p. 574, B.J., XX, 1904, Baluchistan.
*M. apicalis**, Spin., do. do. do. do.
*M. rotundata**, Fabr., do. do. do. do.
*M. desertorum**, Mor., do. do. do. do.
*M. muraria**, Ratz., do. do. do. do.
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M. gathela, Cameron, p. 650, B. J., XVIII, 1908, Deesa.
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†*M. bombayensis*, Cameron, p. 650, B. J., XVIII, 1908, Bombay.
M. lissopoda, Cameron, p. 651, do. do. do.
M. cathena, Cameron, p. 651, do. do. do.
M. cratodonta, Cameron, p. 652, do. do. Deesa.
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M. leptodonta, Cameron, p. 654, B. J., XVIII, 1908, Deesa.
†*M. erythrostoma*, Cameron, p. 655, do. do.
M. suavida, Cameron, p. 655, do. do.
M. nicevillei, Cameron, p. 41, Entomologist, 1908, India.
M. obtusata, Cameron, p. 51, D. Ent. Z., 1909, Ferozepur.
M. striolata, Cameron, p. 131, B. J., XIX, 1909, Simla.
M. heterotrichia, Cameron, p. 132, do. do.
M. semireticulata, Cameron, p 132, do. Ferozepur.
M. ferozepurensis, Cameron, p. 133, do. do.
M. Simlæensis, Cameron, p. 133, do. Simla.
M. melanoneura, Cameron, p. 134, do. do.
Same as *M. maritima*, K. (1802)—Meade Waldo, p. 403, A.M.N.H., XIV, 1914.
M. incepta, Cameron, p. 135, B. J., XIX, 1909, Simla.
M. punjabensis, Cameron, p. 135, B. J., XIX, 1909, Ferozepur.
M. mystacea, *F.* Notes on—Bingham, p. 183, T. Z. S., 1909.
M. funebricornis, Strand, p. 38, Jahr. Ver. Wies., 63, 1910, Ceylon.
M. ladacensis, Cockerell, p. 252, Proc. U. S. Nt., Mus., 40, 1911, Ladak.
M. rupshuensis, Cockerell, p. 253, do. do. do.
M. faceta. Bingham, Cockerell, p. 315, A. M. N. H., VII., 1911, Khasia.
M. caroli.
M. Ceylonensis, Bingham, ♀, p. 482, F. B. I., 1, 1897, Ceylon.
M. caroli, Meade Waldo, p. 464, A. M. N. H., X, 1912.
(wrongly put as *Ceylonica* in Bingham's, F. B. I.)
M. stulta. Bingham. Notes on—Meade Waldo, p. 464, A.M. N.H., X, 1912.
M. binghami.
M. bellula, Bingham, ♂, p. 476, F B. I., I, 1897.
M. binghami, (*new name*) Meade Waldo, p. 465, A. M. N. H., X, 1912.
M. luculenta, Bingham; (a distinct sp. not same as M. Mystacea, *see* p. 479 of Bigham's, F. B. I., i, 1897)—Meade Waldo, p. 466, A. M N. H., X, 1912.
M. semivestita. Smith. ♂, Meade Waldo, p. 467, do. do. (is the ♂, of M. Determinat Smitha, ♀—Meade Waldo.)

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† These two are the same as M. hera, Bingham (1897)—Meade Waldo, p. 403, A. M. N. H., XIV, 1914.

M. atrata.
M. atrata, Smith, ♀, p. 182, Cat. I.
M. viriplacea, Cam., ♂ (1902).
M. shelfordi, Cam., ♀ (1902).
M. atrata, Meade Waldo, p. 467, A. M. N. H., X, 1912.
M. velutina.
M. vetutina, Smith Cat., I, p. 180, ♀.
M. Dimidiata, Smith Cat., p. 174, ♀.
M. velutina, Meade Waldo, p. 468, A. M. N. H., X, 1912.
M. habropodoides, Meade Waldo, p. 472, A. M. N. H., X, 1912, Sikkim.
M. striostoma, Cameron, p. 28, Ind. For. Rec., IV, (2), 1913, Dehra Dun.
M. albifrons, Smith, Food habits of—Burkill, p. 102, JA.S.B., VI, 1911.
M. disjuncta and parevaspis abdominalis. Distinctions—Bingham, p. 58, B. J., XII, 1898.

AGLAOAPIS (*gen. nov.* 1901).

A. brevipennis, Cameron, p. 263, Enthomologist, XXXIV, 1901, Bombay. (This is a typical Dioxy's Lepel—Meade Waldo, p. 496, A. M. N. H., XII, 1913.)

PAREVASPIS.

P. carbonaria, Smith.—Meade Waldo, p. 227, A. M. N. H., VII, 1911.

EUASPIS.

E. smithi.
Parevaspis abdominalis, Smith, p. 79, Journ. Linn. Soc., 1859, ♂.
Euaspis smithi, Friese, p. 137, Allg. Zeit. Ent., IX, 1904.

ANTHIDIUM.

A. flaviventre, Cameron, p. 124, Mem. Manch. Soc., XLI (4), 1897, Poona.
A. desidiosum, Bingham, p. 126, pl. A., fig. 12, B. J., XII, 1898, Deesa.
A. bingami.
A. raternum, Bingham, p. 495, F. B. I., I, 1897.
A. binghami (*nov. name*), Friese, p. 224, Zeit. Hym. Dipt., I., 1901.
A. satlator, Nurse, p. 151, J. A. S. B., LXX, 1902, Deesa.
Do. do. p. 575, B. J., XV., 1904.
A. viaticum, Nurse, p. 152, J. A. S. B., LXX, 1902, Matheran.
A. conciliatum, Nurse, p. 547, A. M. N. H., XI, 1903, Kashmir.
A. florntinum, Fabr.* } Nurse, p. 575, B. J., 1904, Quetta.
A. fedtschenkoi, Mor.* }
A. philorum, Cockerell, p. 242, Entomologist, 1910, Himalaya.
A. ternarium, Cockerell, p. 181, A. M. N. H., VIII, 1911, Quetta.
A. philorum abotti, *var. new*, Cockerell, p. 249, Proc. U. S. Nat. Mus., 40-1911, Ladak.

DIANTHIDIUM.

D. sinapinum, Cockerell, p. 179, A. M. N. H., VIII, 1911, Karachee.
D. rasorium.
Anthidium rasorium, Smith., p. 50, T. E. S., 1875.
D. rasorium, Cockerell, p. 180, A. M. N. H., VIII, 1911.
Anthidium and Dianthidium—Composition—Cockerell, p. 136, A. M. N. H., VI, 1909.

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* New to the region.

PROANTHIDIUM.

P. soliferum, Cockerell, p. 180, A. M. N. H., VIII, 1911, Karachee.

CAMPTOPOEUM.

C. rufiventre, * Mor.
    c. schewyrewi, Mor ?—Nurse, p. 575, B. J., XV, 1904, Quetta.

CERATINA.

C. ornatifera, Cameron, p. 141, Mem. Manch. Soc., XLI, (4), 1897. Mussouri.
C. incognita, Bingham, p. 127, B. J., XII, 1898, Simla.
C. muscatella, Nurse, p. 152, J. A. S. B., LXX, 1902. do.
C. loquata, Nurse, p. 153, do. do. do.
C. ino, Nurse, p. 575, B. J., XV, 1904, Quetta.
C. egeria, Nurse. p. 576, do. do. do.
C. corinna, Nurse, p. 576, do. do. do.
C. lævifrons, Mor.* noted by Nurse, p. 577, do. do.
C. binghami, Cockerell, p. 340, A. M. N. H., I, 1908, Calcutta.
    Do. do. p. 185, A. M. N. H., 1911.
C. eburneopicta, Cockerell, p. 185, A. M. N. H., VIII, 1911, Salsetta.
C. comberi, Cockerell, p. 185, do. do. Karachee.
C. bhawani, (*new form*), Bingham. p. 360. Rec. Ind. Mus., I, 1908.
Ceratina—Notes on—Cockerell. and Porter, pp. 404-406, A. M. N. H., IV, 1899.

NOMOIDES.

N. appendiculata.
    Ceratina appendiculata, Cameron, p. 59, Fauna Mald, I, 1902, Maldives.
    Nomoides *do.* Cockerell, p. 312, A. M. N. H., 1909.
N. karachensis, Cockerell, p. 235, A. M. N. H., VII, 1911, Karachee.
N. comberi, Cockerell, p. 236, do. do. do.
    = *Ceratina punjabensis*, Cam., p. 1003, B. J., XVII, 1907.
    = *N. comberi*, Meade Waldo, p. 403, A. M. N. H., XIV, 1914.
N. divisa.
    Ceratina divisa, Cameron, p. 1003, B. J., XVII, 1907, Quetta.
    Ceratina spilaspis, Cameron, p. 657, B. J., XVIII, 1908, Deesa.
Nomoides cerea.
    Ceratina cerea, Nurse, p. 152, J. A. S. B., LXX, 1902, Deesa.
    Nomoides cerea, Meade Waldo, p. 495, A. M. N. H., XI, 1913.
Nomoides curvilienata.
    Ceratina curvilineata, Cameron, p. 1004, B. J., XVII, 1907, Deesa.
    Nomoides curvilineata, Meade Waldo, p. 495, A. M. N. H., XII, 1913.
Nomoides—Taxonomy, Cockerell, p. 236, A. M. N. H., VII, 1911.

ALLODAPE.

A. pictitarsis, Cameron, p. 60, Fauna Mald., I, 1902, Laccadives.
A. pumilio, Cockerell, p. 182, A. M. N. H., VIII, 1911, Karachee.

HERIADES.

(Eriades, Friese).

E. tenuis Nurse, p. 577. B. J., XV, 1904. Mt. Abu.

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* New to the region.

Cœlioxys.

C. taurus, Nurse, p. 153, J. A. S. B., LXX, 1902, Deesa.
C. stolidus, Nurse, p. 548, A. M. N. H., XI, 1903, do.
C. cariniscutis, Cameron, p. 213, A. M. N. H., XIII, 1904, Khasia Hills.
C. khasiana, Cameron, p. 213, do. do. do.
C. latus, Cameron, p. 658, B. J., XVIII, 1908, Matheran.
C. turneri, Cockerell, p. 418, A. M. N. H., V, 1910, Assam.
C. sulcispina, Cameron, p. 29, Ind. For. Rec., IV, 2, 1913, Dehra Dun.
C. fulvitarsis, Cameron, p. 30, do. do. Mussouri.
C. tenuilineata, Cameron, p. 31, do. do. Simla.

Same as *C. confusa*, Smith (1875), Meade Waldo, p. 404, A. M. N.H., XIV, 1914.

C. fuscipes, Cameron, p. 31, Ind. For. Rec., IV, 2, 1913, Simla.
C. ruficaudis, Cameron, p. 32, do. do. do.

Same as *C. afra*, Lep. (1841), Meade Waldo, p. 404, A. M. N. H., XIV, 1914.

Ceratina species; Cockerell, pp. 85-90, Psyche, XII, 1905.

Crocisa.

C. ramosa Lepel—Sleeping—Green, p. 214, Ent. Mag., 1899.
C. kashmirensis, Nurse, p. 548, A. M. N. H., XI, 1903, Kashmir.
C. elegans, Mor.*, Nurse, p. 578, B. J., XV, 1904, Quetta.
C. ceylonica, Friese, p. 4, Zeit. Hym. Dipt., V, 1905, Ceylon.
C. rostrata, Friese, p. 6, do. do. Simla.

Crocisa—Table of Indo-Australian species of—Friese, pp. 2-12, Zts. Hym. Dipt., V., 1905.

Podalirius.

P. vedettus, Nurse, p. 582, B. J., XV, 1904, Kashmir.
P. connexus. Nurse, p. 583, do. do. Quetta.
P. sergius, Nurse, p. 584, do. do. do.
P. picicornis, Fedt.*
P. albigenus, Lap.*
P. orientalis, Mor.*
P. fulvitarsis, Brulle* } Nurse, p. 585, B. J., XV, Quetta.
P. atricillus, Ever.*
P. velocissimus, Fedt.*
P. khaisanus.

Habropoda fulvipes, Cameron, p. 211, A. M. N. H., XIII, 1904.
Podalirius khasianus, Schulz., p. 253, Spol. Hym., 1906, Khasia Hills.

P. binghami.

Anthophora crocea, Bingham, p. 526, F. B. I., I, 1897.
Podalirius binghami, Schulz.. p. 253, Spol. Hym., 1906.

P. wickwari, Bingham, p. 122, Spol. Zeyl., V., 1908, Ceylon.

Tetralonia.

T. punctata, Cameron, p. 79, Mem. Manch. Soc., XLII (11), 1898, Poona.
T. brevipennis, Cameron, p. 78, Mem. Manch. Soc., XLII (11), 1898, Allahabad.

Characters of T. brevipennis Cam.—Nurse, p. 549, A. M. N. H., XI, 1903.

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* New to the region.

T. ovatula, Cameron, p. 649, B. J., XVIII, 1908, Deesa.
T. glabriocornis, Cameron, p. 649, do. do.
T. pruinosa, Cameron, p. 47, D. Ent. Z., 1909, Ferozepur.
T. punctilabis, Cameron, p. 48, do. do.
T. testaceitarsis, Cameron, p. 49, do. do.
T. erythrocera, Cameron, p. 49, D. Ent. Z., 1908, do.
T. Punjaubensis, Cameron, p. 49, do. do.
T. rufolineata, Cameron, p. 50, do. do.
T. claripennis, Cameron, p. 51, do. do.
T. leucopoda, Cockerell, p. 183, A. M. N. H., VIII, 1911, Nasik.
T. commixtana, Strand, p. 146, Archives Naturges, 79A, 1913, Ceylon.
T. taprobanicola, Strand, p. 147, do. do. do.
Tetralonia and Melissodes.—Comparison of generic characters—Cameron, p. 76, Mem. Manch. Soc., XLII (11), 1898.

TETRALONIELLA.

T. aliena, Cockerell, p. 184, A. M. N. H., VIII, 1911, Nasik.
T. calidula, Cockerell, p. 34, Entomologist, 1913, Salsette.

EUCERA.

E. medusa, Nurse, p. 578, B. J., XV, 1904, Quetta.
E. diana, Nurse, p. 579, do. Kashmir.
E. phryne, Nurse, p. 579, do. Deesa.
E. pomona, Nurse, p. 580, do. Quetta.
E. cassandra, Nurse, p. 581, do. do.
E. melanostoma, Mor.*, Nurse, p. 579, do. do.
E. spectabilis, Mor.*, Nurse, p. 582, do. do.
E. turcestanica, Dalla Torre-*Nurse, p. 582, do. do.
Eucerinae—List of spp. Cockerell, pp. 261-273, Proc. N. 5, Nat. Mus., 1912.

HABROPODA.

H. krishna (*form nov.*), Bingham, p. 366, Rec. Ind. Mus., 1908, Darjiling.
H. turneri, Cockerell, p. 308, Entomologist, 1909, Assam.

ANTHOPHORA.

A. deiopea, Cameron, p. 127, Mem. Manch. Soc., XLI (4), 1897, Mussouri
A. rothneyi, Cameron, p. 142, do. do. do.
A. cellularis, Cameron, p. 80, Mem. Manch. Soc., XLII (11), 1898, Poona.
A. liriope, Bingham, p. 127, B. J., XII, 1898, Deesa.
A. iole, Bingham, p. 128, do. do. Simla.
A. antiope, Bingham, p. 128, do. do. do.

A. zonata, L., varieties; Cockerell, p. 411, A. M. N. H., V, 1910, Dehra Dun.

A. zonata var, puttalama, Strand., p. 147, Archives Naturges, 79 A, 1913 Puttalam (Ceylon).

A. cingulifera.

A. cingulata, Fab. Bingham, p. 526, F. B. I., i, 1897.

A. cingulifera, Cockerell, p. 410, A. M. N. H., V, 1910, Dehra Dun. (The true 'cingulata' according to Cockerell is a different species and Australian).

A. megarrhina, Cockerell, p. 413, A. M. N. H., V, 1910, Sikkim.

A. do. var soluta, Cockerell, p. 414, A. M. N. H., V, 1910, Sikkim.

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* New to the region.

A. khambana, Cockerell, p. 415, A. M. N. H., V, 1910, Sikkim.

A. pulcherrima, Bingham, (*var a*), Cockerell, p. 413, A. M. N. H., V, 1910, Sikkim.

A. orophila, Cockerell, p. 415, A. M. N. H., V, 1910, Sikkim.

A. delicta, Cockerell, p. 235, Entomologist, 1911, India.

A. amolita, Cockerell, p. 237, do. do. do.

A. comberi, Cockerell, p. 493, A. M. N. H., VII, 1911, Nasik.

The homing of burrowing bees (Anthophoridæ)—Turner, p. 247, Biol. Bull., XV, 1908.

Anthophora and Melecta—relations—Johnson, p. 427, Zoologist, 1913.

ANTHRENA.

A. brunneipennis, (*form new*), Bingham, p. 362, Ind. Mus. Rec., II, 1908.

A. burkelli (*form new*), Bingham, p. 363, do. do. do.

XYLOCOPA.

X. ceylonica, Cameron, p. 32, P. Z. S., Pt. II, 1901, Ceylon.

X. tranquebarica, Fabr*—Schulz, p. 273, Zt. Hym. Dipt., 1901.

X. esica, Cameron, p. 61, Fauna Mald:, i, 1902, Maldives.

X. gardineri, Cameron, p. 62, do. do. do.

X. amethystina, signiana—(*new sub sp.*), Cockerell, p. 310, A. M. N. H., VII, 1911.

X. collaris, Lepel, *var* binghami, Cockerell, p. 30, A. M. N. H., XIV, 1904.

X. minor, Maidl., p. 250, Ann. Nat. Hist. Hof. Wien, 1912, Sikkim.

X. amethystina, sigiriana—(*new sub sp.*), Cockerell, p. 310, A.M.N.H.. VII, 1911, Sigiri, N. W. India.

X. madurensis, Friese, p. 88, D. Ent. Z., 1913, Madura.

Xylocopa and acarid pouch—Green, p. 232, Ent. Mag., 1902.

BOMBUS.

B. gilgitensis, Cockerell, p. 223, A.M.N.H., XVI, 1905, Kashmir.

B. waltoni, Cockerell, p. 239, Entomologist, 1910, Himalaya.

B. haemorrhoidalis, Smith—Habits—Burkill, p. 521, J.A.S.B., 1906.

Bombus Habits of Psithyrus and—Sladen, p. 30, Ent. Mag., 1899.

Hovering of Bombus-Saunders, p. 83, Ent. Mag., 1909.

APIS.

A. nursei.

  A. testacea, Bingham, p. 129, B.J., XII, 1898, Deesa.

  A. nursei, Cockerell, p. 319, A.M.N.H., VII, 1911.

A. florea and *dorsata*—combs., Friese, p. 198, Allg. Zeit. Ent., VII, 1902.

A. dorsata and *indica*—Habits—Hooker Agricultural Ledger, 1904, (Calcutta).

A. dorsata—Its domestication—Harris, p. 12, Ent. Record, XIV, 1902.

A. dorsata—Working hours—Burkill, p. 105, J.A.S.B., 1911.

A. dorsata—Friese, p. 278, Ann. Mus. Hung. 7, 1909.

A. florea sub. sp., nasicana, Cockerell, p. 241, Tr. Amer. Ent. Soc., XXXVII, 1911.

Apis—species and distribution—Enderlein, p. 331, Stett. Ent. Zt., 1906.

New generic names—'Megapis' and 'Micrapis'—for dorsata and florea—Ashmead, pp. 120-122, Proc. Ent. Soc., Washington, VI, 1904.

Apis—specific characters—Cockerell, p. 177, Entomologist, XXXVI, 1903.

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* Newly recorded.

MELIPONA.

M. cacciae, Nurse, p. 619, B.J., XVII, 1907, Hoshangabad.
Melipona—Nests and habits of, Schulz., p. 250, Zt. Insbiol, I, 1905.
Trigona—Nests of—Waterhouse, p. 133, T. E. S., 1903.

DASYPODA.

D. comberi, Cockerell, p. 226, A. M. N. H., VII, 1911, Karachee.

MELITTA.

M. altissima, Cockerell, p. 240, Entomologist, 1910, Himalaya.

LAMPROAPIS.

L. maculipennis, Cameron, p. 420, pl. fig. 2, B. J., XIV, 1902, Simla.

EPEOLUS.

E. fervidus, Smith, recorded as from India before 1897, but not in Bingham.

E. fervidus, Smith, Cockerell, p. 668, A. M. N. H., VIII, 1911.
E. pictus, Nyl.*, Nurse, p. 570, B. J., XV, 1904, Quetta.
E. peregrinus, Cockerell, p. 234, A. M. N. H., VII, 1911, Nasik.
Do. *do.* do. p. 668, do. VIII, 1911.
E. assamensis, Meade Waldo, p. 94, A. M. N. H., XII, 1913, Assam.
E. tibetanus, Meade Waldo, p. 95, do. do. Tibet.

PLESIOPANURGUS (*gen. nov.* 1907).

P. cinerarius, Cameron, p. 131, B. J., XVIII, 1907, Quetta.

THYGATINA (*gen. nov.* Cockerell, 1911).

T. fumida, Cockerell, p. 237, Trans. Amer. Ent. Soc. (37), 1911, Ceylon.

MELISSINA (*gen. nov.* Cockerell).

M. viator, Cockerell, p. 670, A. M. N. H., VIII, 1911, Karachee.

TRINCHOSTOMA.

T. sladeni, Cockerell, p. 35, Cand. Ent., 1913, Khasia Hills.

CTENOAPIS (*gen. nov.* Cameron, 1901).

C. lutea, Cameron, p. 117, A. M. N. H., VIII, 1901, Ferozepur.
C. flavomaculata, Cameron, p. 117, do. do. do.
Sexes of C. lutea, Nurse, p. 570, B. J., XV, 1904 (lutea ♀ and flavomaculata ♂).

MELANAPIS.

M. violaceipennis, Cameron, p. 421, pl., fig., B. J., XIV, 1902, Ferozepur.
M. rufifrons, Nurse, p. 567, B. J., XV, 1904, Quetta.

AMMOBATES.

A. solitarius, Nurse, p. 570, B. J., XV, 1904, Quetta.

PASITES.

P. maculatus, Jur, noted by Nurse, p. 570, B. J., 1004, Quetta.

In addition to the numerous papers of Cameron, Bingham, Nurse, Meade, Waldo, Cockerell, Turner, etc., often quoted in the body of the catalogue, the following may be added as recent papers on Indian Aculeates in general :—

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* New to the region.

Aculeate Hymenoptera of Barrackpore—Rothney, pp. 93-116, T. E. S., 1903.

Life histories of Indian Hymenoptera—G. R. Dutt, Mem. Deptt. Agri. India, Ent. Series, Vol. IV, 1912. (*a*)

Hymenoptera of the Abor Country—Nurse and Paiva. Rec. Ind. Mus., Vol. VIII, Pts. I—V., 1912-1914. (*b*)

Hymenoptera from the Himalayas—Paiva. Rec. Ind. Mus., Vol. I., 1907.

The following supplementary list includes some new species recorded from the Indian region since the above list was prepared. A few references to already known species, some of which were overlooked by me before, are also added here :—

MUTILLIDÆ.

Mutilla.

Andre in his paper on Ceylon mutillids has referred to the following species in addition to the new forms noted above (see p. 544), in the D. Ent. Zs., 1907 :—

M. sorror, Sauss, p. 253.
M. insularis, Cam., p. 253.
M. humbertiana, Sauss, p. 255.
M. bicincta, Sauss, p. 255.
M. lilliputiana, Andre, p. 256.
M. ocellata, Sauss, p. 256.
M. hexaops, Sauss, p. 256.
M. acidalia, Cam., p. 256 (see p. 542 above).
M. analis, Lepel, p. 257.
M. indostana, Smith, p. 257.
M. foveata, Cam., p. 257 (see p. 544 above).

THYNNIDÆ.

METHOCA.

Methoca bicolor, Cam., name changed to *M. rufonigra*, Dutt, p. 186, Mem. Deptt. Agri. India, Vol. IV, 1912.

BETHYLIDÆ.

PRISTOCERA (Klug).

P. eironeformis, Turner, p. 245, A.M.N.H., XIV, 1914, Pattikonda, S. India.

SCOLIIDÆ.

ELIS (Mesa).

E. crassipunctata, Turner, p. 246, A.M.N.H., 1914, Coimbatore, S. India.

(*a*) Contains interesting notes on habits and life histories of a number of aculeates.

(*b*) Contains chiefly references to known forms.

POMPILIDÆ.

Psammochares.

*P. nudatus.**
Pompilus nudatus, Sm., Cat., p. 133, 1855 (Trebizond).
Pompilus cassius, Nurse, p. 84, B. J., XIV, 1902 (see p. 549 above).
Pompilus horatius, Nurse, do. do. do.
Psammochares nudatus, Turner, p. 247, A.M.N.H., XIV, 1914 (Coimbatore).

P. detectus.
Pompilus reflexus, Bingham, p. 159, F.B.I., i., 1897 (*nec.*, Smith), Sikkim.
Psammochares detectus, Turner, p. 248, A.M.N.H., XIV, 1914, Palur, S. India.

RHOPALOSOMIDÆ.

Rhopalosoma.

Rhopalosoma—Early stages of a sp., Hood, p. 145, Proc. Ent. Soc., Wash. Vol. XV, 1913.

SPHEGIDÆ.

Ampulex.

A. pilosa, Cam.—Turner, p. 250, A.M.N.H., XIV, 1914 (see p. 555 above).

Chlorion (sphex—Harpactopus).

C. subfuscatus, Dahlb.,* Turner, p. 250, A.M.N.H., XIV, 1914, Coimbatore.

Gorytes.

G. cœrulescens, Turner, p. 251, A.M.N.H., XIV, 1914, Kandy, Ceylon.

Nysson.

N. excavatus, Turner, p. 253, A.M.N.H., XIV, 1914, Coimbatore.
N. decoratus, Turner, p. 254, do. do. do.
N. dubitatus, Turner, p. 255, do. do. do.
N. basalis, Smith, Turner, p. 254, do. do. do.

Parapiagetia, (Kohl.*)

P. wickwari, Turner, p. 256, A.M.N.H., XIV, 1914, Colombo, Ceylon.

Lyroda.

L. nigra.
Odontolarra nigra, Cam. (see p. 553 above).
Lyroda nigra, Turner, p. 256, A.M.N.H., XIV, 1914.

Liris.

L. ducalis.
L. ducalis, Smith, Bingham, p. 207, F.B.I., i., 1897.
L. nigripennis, Cam., Bingham, p. 206, do. do. Poona.
L. ducalis, Turner, p. 257, A.M.N.H., XIV, 1914.

DIPLOPTERA.

Notes on the nesting habits of some solitary wasps—Parker, p. 70, Proc. Ent. Soc., Wash., 1915.

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* New to the region.

Habits of a mud dauber—'*Eumenes latreille*, Sauss'—Girault, p. 28, Zt. fur. Wies. Ins., 1914.

On the species of 'Alastor' and other Eumenidæ—Perkins, p. 563, P.Z.S., Pt. II, 1914.

Notes on Belonogaster—Saussure, p. 199, Ann. Soc. Ent. Fr., 1909.

'Belonogaster' and Tachinids—Lamborn, p. XXXIX, T.E.S. II, 1914.

Notes on Wasps and colours of wasps—Perkins, p. 677, T.E.S., 1912.

ANTHOPHILA.

APIDÆ.

SPHECODES.

S. turneri, Cockerell, p. 430, A.M.N.H., XVII, 1916, Assam.

HALICTUS.

H. vinctus.
- *Nomia cincta*, Wlk., 1860, Ceylon.
- *Nomia cincta*, Bingh., p. 458, F.B.I., i., 1897.
- *Halictus kalutaræ*, Cock, (see under 'Halictus' above).
- *Halictus vinctus*, Meade Waldo, p. 449, A.M.N.H., XVII, 1916.

NOMIA.

Nomia—Notes on the genus and sub-genera—Meade Waldo, p. 454, A.M.N.H., XVII, 1916.

N. exagens.
- *Halictus timidus*, Bingham, p. 429, F.B.I., i., 1897.
- *Andrena exagens*, Wlk., p. 305, A.M.N.H., 1860, Ceylon (see under 'Andrena' above).
- *Nomia exagens*, Meade Waldo, p. 459, A.M.N.H., XVII, 1916.

N. aurifrons, Smith, Meade Waldo, p. 459, A.M.N.H., XVII, 1916.

N. fuscipennis, Smith, Meade Waldo, p. 459, do. do.

N. scutellata.
- *N. scutellata*, Smith—Bingh, p. 458, F.B.I., i., 1897, ♀.
- *N. albofimbriata*, Cam. (see above under 'Nomia', ♀.)
- *N. ustula*, Cock (do. do. Ceylon. ♂.)
- *N. scutellata*, Meade Waldo, p. 461, A.M.N.H., XVII, 1916.

N. antennata var *sykesiana*, West.—a well marked variety, Meade Waldo, p. 461, A.M.N.H., XVI, 1916.

N. carinata, Smith, Nelliotii Smith, Meade Waldo, p. 461, A.M.N.H., XVII, 1916.

MEGACHILE.

Sense of locality of a leaf cutting bee, Muir, p. 375, B. J., XXIV, 1916.

TETRALONIA.

Tetralonia—Note on the genus, Cameron, p. 76, Mem. Manch. Soc., XLII (11), 1898.

T. duvacelli, Lepel, Sexes, Cameron, p. 49, D. Ent. Zs., 1909.

ANTHOPHORA.

A. rowlandi, Meade Waldo, p. 50, A.M.N.H., XIII, 1914, Assam.

A. pseudobomboides, Meade Waldo, p. 53, do. do. do.

XYLOCOPA.

X. amethystina, F. Friese, p. 88, D. Ent. Zs., 1913.

APIS.

A. binghami var *sladeni*, Cock, p. 13, A.M.N.H., XIV, 1914, Khasia.

MELITTA.

M. harrictæ.

Andrena harrictæ, Bingh, p. 446, F.B.I., i., 1897.
Melitta altissima, Cockerell (see under 'Melitta' above).
Melitta harrictæ, Meade Waldo, p. 462, A.M.N.H., XVII, 1916.
M. anthophoroides, Meade Waldo, p. 463, A.M.N.H., XVII. 1916, Sikkim.

BOMBUS.

B. lapidarius, *L.* var. *gilgitensis.*

B. gilgitensis, Cock (see under 'Bombus' above).—Meade Waldo, p. 467, A.M.N.H., XVII, 1916.

B. alienus, Smith,* Meade Waldo, p. 468, A.M.N.H., XVII, 1916, Assam.

B. longiceps, Smith,† Meade Waldo, p. 468, A.M.N.H., XVII. 1916, Kashmir.

EPEOLUS.

Synopses of Epeolinæ—Robertson, p. 284, Canad. Ent., 1903.

TRINCHOSTOMA.

T. assamensis, Sladen, p. 214, Canad. Ent., 1915, Assam.

It is still possible that I might have omitted some new species or important references. As such, I shall be very grateful to those of your readers who might be able to point out these omissions or any errors in my Catalogue, as it will greatly help me in the future.

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* Omitted by Bingham.
† New to the region.

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BUTTERFLIES OF THARRAWADDY AND THE PEGU YOMA.

BY

E. V. ELLIS, I.F.S.

With a Map.

The accompanying list deals chiefly with butterflies caught in the Tharrawaddy District, which lies on the western slopes of the Pegu Yoma, but for the sake of completeness reference has been made to others caught in Prome, Rangoon, Henzada and Toungoo Districts.

The Pegu Yoma forests seem to house an interesting set of butterflies, as they form the meeting place for Malayan and Assam types, and yet they are isolated by paddy plains and big rivers on both sides. They begin at Rangoon and extend to Mt. Popa in Meiktila, more or less. The jungles of the Tharrawaddy District are chiefly at a low elevation, under 500 feet, but towards their Eastern boundary they rise to 2,600 feet in the main ridge. There are three main types of jungle, each inhabited by characteristic insects :—

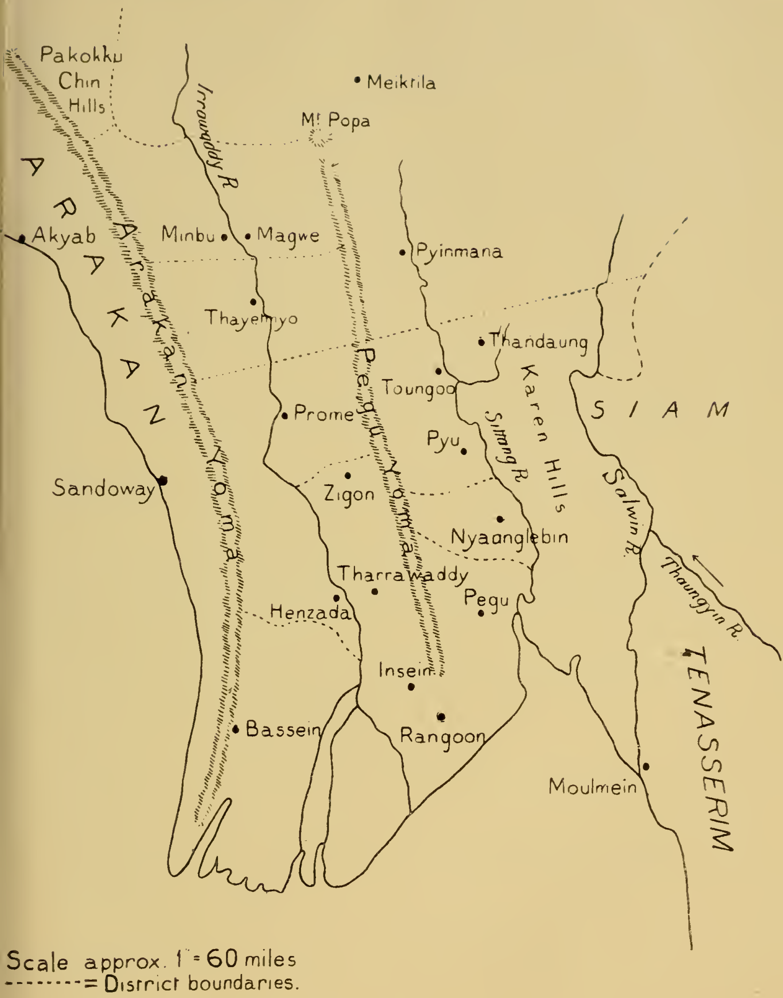
i. Deciduous bamboo jungle, fairly dry in the hot weather. This covers 90 per cent. of the area.

ii. Evergreen jungle found in local patches near certain streams, very rich in species.

iii. "*Indaing*" jungle, low level gravel, etc., characterized by the presence of *Dipterocarpus tuberculatus*, the "In" tree. This is inhabited especially by *Arhopala tounguva, hewitsoni* and *centaurea* and *Elymnias tinctoria.*

Of the other districts mentioned, Prome adjoins Tharrawaddy on the north, and Toungoo adjoins it on the east, being on the opposite slope of the Yomas. Rangoon, situated at the tail of the Yoma, is surrounded by patches of evergreen forest in which rather more Malayan types appear. Henzada lies to the west across the Irrawaddy, and consists of broad and rather dry plains backing on to the hills of the Arakan Yoma which rises to 5,000 ft. The butterflies from the plain forests of Henzada are the same as those met with in Tharrawaddy plains forests, but the hill insects are rather different.

The present list cannot pretend to be complete for such a wide area as the Pegu Yoma, but it represents four years collecting in Tharrawaddy, and should be fairly complete for that District. To finish the Pegu Yoma butterflies more research is needed in the moister forests on its eastern slopes in the Pegu and Toungoo Districts. It is hoped that the present list will assist anyone engaged on that work. Finally I must express my great obligation to


Pakokku
Chin Hills
Meikrila
Mt Popa
Irrawaddy R.
ARAKAN
Akyab
Minbu
Magwe
Pyinmana
Arakan Yoma
Thayetmyo
Thandaung
Pegu Yoma
Toungoo
Karen Hills
SIAM
Prome
Sittang R.
Pyu
Sandoway
Zigon
Salwin R.
Nyaunglebin
Tharrawaddy
Thaungyin R.
Pegu
Henzada
TENASSERIM
Insein
Bassein
Rangoon
Moulmein
Scale approx. 1" = 60 miles
-------- = District boundaries.

MAP OF THE THARRAWADDY AND THE PEGU YOMA, LOWER BURMA.

Major W. H. Evans, R.E., who has very kindly identified all doubtful specimens and helped me in every way possible.

NYMPHALIDÆ.

Danainæ.

1. *Danais aglea melanoides*, M. Very common everywhere. I have obtained *D. agleoides* around Rangoon and from Bassein. In the former place, at any rate, it was flying with *melanoides*, but it seems to reach its northern limit about Rangoon and I have met with none in Tharrawaddy, Toungoo or further north.

2. *D. limniace*, Cr. Very common everywhere.

3. *D. plexippus*, L. Very common.

4. *D. chrysippus*, L. Very common.

I have *D. melanippus indicus*, Fruh. From Rangoon but it comes no further north.

5. *Euplæa godarti*, Lucas. This is the common Euplæa of Lower Burma, and it is found in profusion throughout Tharrawaddy. The dimorph, *layardi*, Druce, seems to be rare, and I only have one from the Henzada District.

6. *E. alcathoe æsatia*, Fruh. Not common. I got it once in the Thonze Reserve on 2nd March 1913. *E. harrisi hopei* should occur but I have not met with it.

7. *E. mulciber*, Cr. Very common.

8. *E. crassa*, But. Not uncommon and probably many could be got in the right place. Of four specimens that I have set, one, a rains form, might probably be called *masoni*, Moore, while the other three which are d. s. f. seem from the scanty descriptions in Seitz to be equally referable to *crassa apicalis, pembertoni* or *burmeisteri*.

9. *E. diocletiana*, Fabr. This is not common, but I obtained it in the Thonze Reserve in May 1912. Like *E. alcathæ* and *crassa* it prefers moister jungle than is usually met with in Tharrawaddy.

Satyrinæ.

10. *Ypthima hübneri*, Kir. Very common everywhere.

11. *Y. watsoni*, M. Fairly common in the forest and I obtained a good series in January, February and onwards.

12. *Y. philomela indecora*, M. As mentioned by Major Evans in Journal, B. N. H. S., Vol. XXII, No. 2, page 282. I obtained a good series of this insect in February 1913 at Yetho and Sanbok villages. I also find I have it from the Henzada District.

13. *Y. baldus*, Fabr. Very common. Whether I have mixed up *sobrina* and *similis* among my *baldus* I cannot say, but it seems likely.

14. *Y. dohertyi*, M. One specimen from the Kyanktada hill on the Yoma, 2,640′, on 16th November 1911.

15. *Y. savara*, G-Smith. Common from February onwards. I have met it in other parts of Burma where it was also common, from the Arakan Yoma in Minbu District to the North Shan States close to Yunnan.

16. *Erites rotundata*, de Nic. This is a local insect, but when found can be obtained in numbers. Particularly frequents bamboo jungle, and flies

weakly in their dense shade, settling on their stems or leaves. All my specimens seems to be *rotundata* and not *angularis*; they are all d. s. f. The insect appears in February.

17. *Lethe europa*, Fabr. This is common in the forest and usually sits on the banks of dry streams, a habit all Lethes seem to have.

18. *L. confusa*, Aurivill. Also common.

19. *L. minerva*, Fabr. One male and two females from the Taungnyo Reserve. Rare specimens taken on 18th February 1911 and 18th April 1911.

I also have this from the North Shan States and from Toungoo.

20. *L. mekara*, M. Rather commoner than *chandica* or *vindhya*. Emerges in February also. I have record of seven Tharrawaddy specimens, ranging from 31st January 1911 to 3rd May 1912 and one on 14th November 1911. They come from the Taungnyo, Bawbin and Bilin Reserves, and one from the Taungnyomyo.

21. *L. chandica*, M. Not common. Emerges in March. Bawbin Reserve 14th November 1911, also Konbilin Reserve.

22. *L. vindhya*, Felder. Not common. Appears in February. Konbilin and Yetho streams on 16th February 1911 and 12th February 1912.

23. *L. muirheadi bhima*, Mar. Rare. I caught one (3rd May 1911) and saw two others in the Taungnyo Reserve—Pannyogale stream.

Very common in the North Shan States in April and May.

24. *Mycalesis anaxioides*, Mar. One from the source of the Mokka stream, where there is perennial water and evergreen forest, on 20th January 1912.

25. *M. perseus*, Fabr. Occurs all the year round, fairly plentifully.

26. *M. mineus*, L. This also occurs, but rather sparingly and I have only taken a few.

27. *M. perseoides*, M. This is the common Mycalesis of Lower Burma and is to be met with everywhere and at all seasons.

28. *M. intermedia*, M. This doubtless occurs, as I have it from Rangoon in November, but at present I have not been able to distinguish it from the preceding species.

29. *M. malsara*, M. This occurs fairly commonly in the forest. It appears towards the end of February.

30. *M. mnasicles perna*, Fruh. This appears in March and is only found in heavy bamboo jungle. The banks of dry water courses, especially quite small ones, are the usual places to find it. It seems local, but is not uncommon when the right locality is found. Konbilin in March.

31. *M. mystes*, de Nic. Another species that does not fly in the cold weather but only appears towards the end of February. Then it is not uncommon and several may be got in any day's collecting if attention is given to mycalesis. They are found in bamboo jungle, and settle on the ground on the dead bamboo leaves, where the yellow of their undersides is not conspicuous.

32. *M. meda*, Fabr. This is very common: forms with the white stripe obsolescent are found not infrequently, flying with striped specimens so that this variation does not seem to be seasonal. *M. visala*, M., does not seem to occur, and I have not differentiated *M. subdita*.

33. *Melanitis leda ismene*. Cr. Very common.

34. *M. phedima bela*, M. Not common. Only a few taken.

35. *Anadebis diademoides*, M. To be found in the moister parts of the jungle and especially flies along streams that contain running water. Obtained at the source of the Mokka at end of January and also in the Bawbin Reserve.

36. *Elymnias hypermnestra tinctoria*, M. Occurs, but not commonly. Often found in Indaing jungle, December and January.

37. *E. nesaea timandra*, Wallace. I took four on the top of the Yoma, Kyanktada hill, 2,640 feet, on 16th November 1911. 3 ♂ and 1 ♀. I have seen it nowhere else in Tharrawaddy.

Morphinæ.

38. *Clerome arcesilaus*, Fabr. Not common and only found in evergreen forest. Thonze Reserve in May.

39. *Thauria aliris intermedia*, Crowley. I have got three, all at the sources of streams near the Yoma. Inhabits evergreen forest.

40. *Discophora celinde continentalis*, Staud. Seems to be rare. I have one ♂ from the Bilin stream (3rd February 1912). From the Arakan Yoma in Henzada I have 1 ♂ and 2 ♀ taken on 2nd January 1912; 14th March 1912 and a rains ♀.

41. *D. tullia indica*, Staud. Common but hard to take. It sits on the stems of bamboos well protected by the rest of the clump. Only found in the moister bamboo jungle. Appears at the end of February.

42. *Enispe euthymius*, Doubl. Fairly common, and seems to occur in any kind of jungle. The form I have taken in the dry season is *tessellata* M. The prominence of the discal bar on the underside varies a good deal.

Nymphalidæ.

43. *Charaxes polyxena hierax*, Felder. Not very common. Occurs in January and February.

44. *C. fabius sulphureus*, Roth. Not common. I have taken it at the end of February.

45. *Eulepis athamas*, Drury. This is common and pugnacious. Usually it is found sitting on some point of vantage whence it chases everything.

46. *E. arja*, Felder. This is not common. One from the Bawbin stream on 17th November 1911. I only have three others, one from Toungoo and two from Maymyo.

47. *E. deephis concha*, Wd. Rare. I have taken only two and seen no more. Koubilin Reserve, 12th February 1912, and Mokka Reserve, 15th February 1913.

48. *E. eudamippus*, Doub. Rare. I found this once at the source of the Mwegyi stream, Taungnyo Reserve (18th April 1911) and caught two out of a fair number seen. When alarmed they flew to the tops of trees and one specimen I fetched down very luckily with my net stuck precariously into a 30 foot dead bamboo.

I have *eudamippus* also from the Minbu District in February (Dive stream) and the form *nigrobasalis*, Lathy, from the N. Shan States in May.

49. *Apatura ambica*, Koll. I obtained one, a female, in the Taungnyo Reserve, Wetto stream source on 16th February 1911. This is the only one I have seen in Tharrawaddy. She was settled on a small bamboo-like grass which grows beside streams.

50. *A. parisatis*, God. I have only seen one, a ♂. It was on the Kyauktada hill, Bawbin Reserve in November.

51. *Euripus halitherses*, Doub. Again I have only seen one, a male, and that I caught in the Wetto stream, Taungnyo Reserve on 16th February 1911, at 500 feet elevation.

52. *Dichorragia nesimachus*, Boisd. I saw one, but did not catch it, at the source of the Bawbin stream, 600 feet elevation, in a rather evergreen bit of jungle. Usually it seems to occur at higher elevations than this.

53. *Adolias dirtea*, Fabr. Very common in the forest all the year round. The form that occurs seems to be *jadeitina*, Fruh. The submarginal series of spots on the upper side of the hind wing varies in size to a considerable extent, and to a less extent in shape.

54. *Euthalia derma*, Koll. Not very common and seems confined to moist evergreen jungle, but I have seen it in "Indaing" jungle also. Thonze Reserve in May. Seywa in January. Kyini Reserve in February.

55. *E. lepidea*, But. The commonest Euthalia: found at all times of the year, rains forms are darker than d. s. f.

56. *E. appiades julii*, Bougain. Both sexes of this are common, and the form that flies in Tharrawaddy seems nearest to *julii*.

57. *E. jahnu*, M. This also is fairly common and I have taken both sexes. February-March.

58. *E. anosia*, M. One worn specimen taken in April in the Thonze Reserve. It insisted on sitting on the roof inside a bungalow, and after half an hour's chasing, during which it left the place once but returned, it allowed itself to be caught. In February I saw another, a fresh specimen, but had no net with me and it was not docile enough for the finger and thumb method.

59. *E. kesava rangoonensis*, Sw. I do not seem to have got this from Tharrawaddy, but it should occur. It never seems to be common anywhere.

60. *E. apicalis*, Voll. I have one male taken in my garden in Tharrawaddy in April.

61. *E. phemius*, Doub. One good specimen on 5th May 1912 in moist evergreen jungle in the Thonze Reserve.

62. *E. lubentina*, Cr. One female on the Taungnyo-myo in April, and I saw another in the Thonze Reserve in May.

63. *E. garuda*, M. Not so common as lepidea, appiades or jahnu. I got one on the Kyanktada hill, 2,640 feet, on 16th November 1911, and others at lower levels.

64. *E. jama*, Felder. I obtained what I take to be a female of this on the Kyanktada hill on 16th November 1911.

65. *E. eriphyle*, de Nec. This flies with *appiades* and I did not distinguish the females at first. Both sexes were obtained in February and March, but either the female is commoner than the male, which is not usual with Euthalia, or I have been overlooking it as I only have the one worn male.

Of the above species of Euthalia, *appiades*, *jahnu* and *lepidea* are the common ones which occur in most kinds of jungle. The occurrence of the other species is dependant on the existence of evergreen forest, in patches of which single specimens have been found.

66. *Parthenos gambrisius*, Fabr. Not plentiful, as it prefers moisture forest than is usually found in Tharrawaddy.

67. *Liminitis procris*, Cr. Fairly common in the forest, and I have also seen it in the railway town of Letpadan, quite 8 miles from the nearest bit of good jungle.

68. *Lebadea martha*, Fabr. Usually to be found when one meets with a patch of evergreen jungle.

69. *Pantoporia nefte inara*, Doub. One from the Kyanktada hill, 2,640 feet, on 16th November 1911. I have not seen any others in Tharrawaddy and think it prefers a higher elevation, over 3,000 feet.

P. selenophora and *P. cama* may also occur on the top of the Yoma, but I have not met with them.

70. *P. kanwa*, M. I obtained this on the Yoma crest in the Kadin Bilin Reserve (1st February 1913) at an elevation of about 1,500 feet. Again in the Mokka Reserve in January and February 1913.

71. *P. ranga*, M. Two from the Kyanktada hill on 16th November 1911. Not seen again.

72. *P. perius*, L. Very common at all elevations.

73. *P. pravara*, M. Obtained in the Thonze Reserve in May 1912, and again in the Mokka Reserve in February 1913.

74. *Neptis hylas adara*, M. Very common and various in size. All the year round.

75. *N. soma*, M. Also very common and exceedingly variable, some specimens being quite minute in size. January-February and all the year.

76. *M. columella martabana*, M. Common locally : it also seems to vary much, some specimens having the white markings so reduced as to give the insect quite a different look. (9th March 1912).

77. *N. harita*, M. Two or three specimens from the Thonze Reserve. (4th May 1912).

78. *N. viraja*, M. I got this from both the Kyanktada and Kanbalu hills in November 1911. Both are hills on the Yoma about 2,600 feet high.

79. *N. heliodore*, Fabr. This is not very common, but occurs at low elevations along with *paraka*, with which it is easily confused.

80. *N. hordonia*, Stoll. Very common at all elevations and at all times of the year.

81. *N. paraka*, But. Also common, nearly equally with the last named from which it is not to be distinguished until caught. It always settles with its wings wide open, so that one has no chance of a glimpse of its under side.

82. *Cyrestis risa*, Doub. } These two forms fly together, and are to
83. *C. rahria rahrioides*, M. } be found chiefly in streams in moist jungle. I have record of their capture in January, February, October and December.

84. *Junonia iphita*, Cr. Common all the year round both in jungle and gardens.

85. *J. lemonias*, L. Still more common.

86. *J. hierta*, Fabr. Also very common everywhere.

87. *J. orithya*, L. Not quite so common. Most usually found on short herbage.

88. *J. atlites*, Joh. Fairly common. Chiefly found in gardens.

89. *J. almana*, L. Very common.

90. *Symbrenthia lucina*, Cr. Common in the jungle. I have found no *Vanessa* in Tharrawaddy, but *V. cardui*, should occur as I have it from the Prome hill in July 1909.

91. *Rhinopalpa polynice birmana*, Fruh. Though I have not actually caught this, I saw it in the Mokka stream in January.

92. *Yoma sabina vasuki*, Dohert. Common in the jungle. The rains brood is markedly darker than the hot weather brood that it succeeds. The d. s. f. begins to appear in February, and the insects flying at the end of April and beginning of May are very battered and pale. With the first good showers in May the w. s. f. appears. May 19 is a date I have noted for this. The insects are fond of settling on cattle-stamped mud round village wells, inside the wells on the damp bricks, or along roads through the jungle. Kangyi Reserve in May.

93. *Hypolimnas bolina*, L. Very common. I have not caught *H. misippus* L. in Tharrawaddy, but it must occur.

94. *Penthema yoma*, Mihi. Two specimens of this from the Myaung stream (Gamon Reserve) and from the Thabyu stream (Thonze Reserve), both in May, 1909 and 1912. It inhabits moist jungle, and seems to be the kind of *Penthema* peculiar to the Pegu Yoma forests. I have *P. lisarda* from the Henzada District and *P. darlisa* from the foot of the Karen Hills in Toungoo District. The type specimen of *P. yoma* is in the B. M. and was recently described by me in the journal of the B. N. H. S., Vol. XXII, page 585. February 2nd, 1915.

95. *Kallima inachus limborgi*, M. Not common, as there is not much of the evergreen jungle it prefers. It is sometimes found in "Indaing" jungle.

96. *Issoria Sinha*, Koll. Not very common. Occurs in the jungle.

97. *Atella phalantha*, Drury. Very common everywhere. I have not obtained *A. alcippe alcippioides* and find it much rarer and limited to Tenasserim and East Toungoo as far as my experience goes as yet.

98. *Cupha erymanthis lotis*, Sulz. Very common everywhere.

99. *Cirrochroa mithila*, M. Not very common, but I have records of it from the Bawbin Reserve on 13th November 1911 and again in April in the Thonze Reserve.

100. *Ergolis ariadne*, Johans. Never very common but to be found in most jungle.

101. *Ergolis merione*, Cr. About equally common.

102. *Laringa horsfieldi glaucescens*, de Nec. I obtained this on the top of the Yoma at 2,600 feet, three on the Kyanktada hill, 16th November 1911, and two on the Kaubalu hill, 20th November 1911—four males and one female. I have not seen it elsewhere in Tharrawaddy.

103. *Pseudergolis wedah*, Koll. Not very common.

104. *Cethosia cyane*, Drury. Not common, and seems to inhabit open Savannah jungle by preference, or gardens. Bingham records *C. hypsina*, Fd., from the Pegu Yoma. I have not found it.

105. *Libythea myrrha*, Godart. I have this from Henzada and Toungoo but seem to have failed to take it in Tharrawaddy.

NEMEOBIIDÆ.

106. *Zemeros flegyas*, Cr. Fairly common in moist jungle.

107. *Taxila haquinus fasciata*, M. I have obtained three specimens only in Tharrawaddy. The jungle does not appear to be moist enough for them. One was from the Bawbin Reserve on 25th January 1911 and the others from the Mokka Reserve on 19th January 1912.

108. *Abisara echerius angulata*, M. Very common and variable. Presumably my specimens are this race. I have taken no Dodona in the Pegu Yoma as yet.

PAPILIONIDÆ.

109. *Papilio helena cerberus*, Felder. } Both occur not uncommonly, and
110. *P. æacus*, Felder. } are found either in or out of jungle.
They frequent the white flowers of a flowering shrub.

111. *P. zaleucus*, Hew. Four, taken in streams in the forest.

112. *P. aristolochiæ*, Fabr. The race *goniopeltis*, Roth., is common everywhere, and is the commonest Papilio of the district.

113. *P. clytia*, L. *Clytia* and *dissimilis* forms are equally common and are especially found in gardens.

114. *P. mahadeva*, M. One specimen was obtained, caught in a hat! Thonze Reserve.

115. *P. demoleus*, L. The form *malayanus*, Wall., is nearly as common as *aristolochiæ*. It inhabits gardens by preference, but is to be met with everywhere.

116. *P. chaon*, Westw. Flies with *helenus*. One specimen, dated 25th February 1912.

117. *P. helenus*, L. I first found this in November on the top of the Yoma at 2,600 feet, but later on I also found it at lower elevations. It usually seems to follow a well defined "path" of its own, and I have not often found it loitering. Exclusively a forest insect, in this district at any rate. Kaubala Hill, 20th November 1911.

118. *P. polytes romulus*, Cr. Common, but I have only found the *polytes* form of ♀ as yet.

119. *P. memnon agenor*, L. Not very common, but sometimes met with in gardens on flowers of Hibiscus, etc. The dark males seem always to lack the red mark at the base of the cell on the underside of the fore wing. I have caught two forms of ♀ ; *agenor*, L. and *alcanor*, Cr.

120. *P. palinurus*, Fabr. I have caught two—one in my hand when feeding on wet sand, and I have seen two others. Rare, and appears to be confined to jungle.

121. *P. nomius swinhœi*, M. Common in the jungle, appearing towards the end of Feb. Often found settled in clouds on wet sand.

122. *P. aristeus hermocrates*, Felder. I have only caught two, and it was with the same sweep of the net that also caught two *Swinhœi*. They were settled thickly by a pool on the sand, evidently intermingled. I could not find another though I netted innumerable *Swinhœi* afterwards in a vain search.

123. *P. sarpedon*, L. Not very common.

124. *P. agamemnon*, L. Not common.

125. *Leptocircus meges virescens*, But. I saw this at the source of the Mokka stream in evergreen jungle, but was unable to catch it. Feb.

PIERIDÆ.

126. *Leptosia xiphia*, Fabr. Common at all times of the year in the forest.

127. *Delias descombesi leucacantha*, Fruh. From the top of the Pegu Yoma, at 2,600 feet in November 1911.

128. *Delias aglaia*, L. From the top of the Yoma also, in November. *Delias* seem to prefer higher altitudes than Tharrawaddy can provide, at I have *agostina*, *hierta*, and *pyramus* from the Arakan Yoma in the Henzada District. From the Toungoo district I also have *hierte* from low elevations, taken at flowers in my garden there.

129. *Huphina nerissa dapha*, M. Fairly common.

130. *Huphina nadina*, Lucas. I have no specimen of this from Tharrawaddy, but it must have been passed over. I have a ♀ from Prome and several specimens from Henzada. *Lea.* does not come so far north in the Irrawaddy valley although it extends up the Sittang valley to Toungoo.

131. *Appias lyncida hippoides*, M. Fairly common, but I did not take many. One female from Kyankwa on 5th May 1911, and a few males as different dates.

132. *Appias libythea zelmira*, Cr. Fairly common. Rains forms occur from the end of May until December. I have a fresh specimen of the w. s. f. from the Bawbin Reserve, dated 19th November 1911.

133. *A. albina confusa*, Fruh. Not common. I only have one female from the Pegu Yoma, 2,000 feet, dated 21st March 1912.

134. *A. melania adamsoni*, M. One specimen from Zigon in 1910. This is very similar to some *paulina* that I have from Ceylon.

135. *A. indra*, M. Only from the top of the Yoma. Two from 2,600 feet on 16th November 1911 and one from 2,000 feet on 21st March 1912.

136. *A. lalage*, Doub. Also only from the top of the Yoma. Two on 16th November 1911 from 2,600 feet elevation. Presumably they are the form *argyridina*. But, they are certainly not *lagela*, M., which might have been expected.

137. *Ixias pyrene latifasciata*, But. I have never seen an Ixias in the Tharrawaddy District. It occurs in other districts all round, and I have it from Prome (6th July 1911), Henzada and Toungoo (December 1905). I have also seen it in Rangoon.

138. *Catopsilia pyranthe*, L. Very common at all times of the year.

139. *C. crocale*, Cr. I have at present one male of the form *flavescens*. Fruh. (21st April 1911) and no females.

140. *C. pomona*, Fabr. This occurs more commonly and the female form *catilla*, Cr. also occurs. Until lately I had not separated *crocale* from *pomona* and gave the combined species but little attention in Tharrawaddy. Nearly all my *catopsilia* of are earlier captures. *Catopsilia* is common in Tharrawaddy but I am not in a position to say which particular form they are.

141. *Terias læta*, Boird. Occurs. Bawbin Reserve, 31st November 1909.

142. *T. hecabe*, L. Very common all the year round.

143. *T. silhetana*, Wallace. This also occurs and I have specimens from the Mokka Reserve, 19th January 1912, and from the Taungnyo Reserve, 15th February 1912.

144. *T. andersoni*, M. I have specimens which I believe may be referred to this species, but I am not very sure about them.

145. *T. harina burmana*, M. This occurs, but not very commonly. I have specimens as follows :—

Kaubalu hill, 2,600 feet, 20th November 1911 ; Oamon Reserve, 3rd March 1911 ; Bawbin, 2nd May 1911 ; Taungnyo-myo, 9th June 1911 ; Pegu Yoma, 2nd May 1911.

The w. s. f. has more black on the tip of the wing than the d. s. f.

146. *Hebomoia glancippe*, L. Common, especially at flowers in gardens. May also be seen in clearings and along open streams in the forest.

147. *Pareronia valeria hippia*, Fabr. Fairly common. Flies along its own paths through the jungle, preferring dry open stream beds. Rather hard to catch. Females are much rarer than males, but both forms occur that with yellow most commonly.

LYCÆNIDÆ.

Gerydinæ.

148. *Gerydus biggsii*, Dist. One specimen of what must be this species was taken in the Yetho stream in March, but it does not agree very well with de Nicéville's figure of *G. gopara* which = *biggsi.*

I have not met with any of the more usual forms of *Gerydus* in Tharrawaddy.

149. *Allotinus drumila*, M. This does not seem to have been recorded from Burma yet. I got one specimen from the Sababontaung, 5,000 feet, on the Arakan Yoma, Henzada, on 6th April 1911.

150. *A. subviolaceus*, Felder. No allotinus is common in Tharrawaddy, but what I did catch were about equally divided between this species and *horsfieldi*, about six of each. Kyini Reserve.

151. *A. horsfieldi*, M. A few.

152. *A. nivalis*, Druce. I got two of these in a wet and shady streamlet in the Thonze Reserve in May 1912. They might easily be passed over as small moths on the wing.

153. *Logania marmorata*, M. One specimen which seems nearest to the form *watsoniana*, de N., was taken on 10th January 1913 at Panhle té on the Mokka stream. On the wing it exactly resembles *Lampides celeno*, which is very common, and what impelled me to catch it I do not know.

Lycæninæ.

154. *Pithecops hylax*, Fabr. I have no specimen from Tharrawaddy but believe it occurs. I have it from Henzada.

155. *Neopithecops zalmora*, But. This is fairly common, but local. When the right locality has been found a fair number may be obtained, 19th January 1912 ; 14th April 1912 ; 10th May 1912.

156. *Taraka hamada*, Druce. I have only obtained one specimen in Tharrawaddy, in the Mokka Reserve in January 1913. Elsewhere, I found it very common in the North Shan States.

157. *Cyaniris marginata*, de Nec. Probably occurs but I have no Tharrawaddy specimen.

158. *C. puspa*, Hors. I have specimens as follows:—Bawbin Reserve, 3rd January 1911; Pegu Yoma, 21st January 1912; Kanbalu hill, 2nd February 1911 and 20th November 1911 (2,600 feet); Kyanktada hill, 16th November 1911 (2,640 feet). It seems commoner at high elevations, but I have low level specimens from Prome hill, 200 feet, dated 5th July 1911.

159. *C. jynteana*, de Nec. I have two specimens of this from the Kanbalu hill, 2,600′, dated 2nd February 1911. No others were met with.

160. *C. albidisca*, M. A cyaniris near to this was found in the Mokka stream on 20th January 1912.

161. *C. melæna*, Dohert. Two from the Kyanktada hill, 2,600 feet, on 16th November 1911.

162. *Chilades laius*, Cram. Not very common, but is sometimes met with in gardens.

163. *C. trochilus*, Frey. Very common wherever there is short grass and weeds in dry paddy fields, or on dry land liable to inundation.

164. *Zizera lysimon*, Hüb. Fairly often found, in localities similar to the last.

165. *Z. gaika*, Fabr. } Both are common, in open grassy places, and on
166. *Z. otis*, Fabr. } the bunds of paddy fields in the dry weather *Z. maha.*, Koll., does not seem to occur in this district, although Bingham records it from Pegu.

167. *Everes argiades dipora*, M. Not very common: found both inside and outside the forests.

168. *Catochrysops strabo*, Fabr. Very common everywhere *C. lithargyria* I have not been able to find.

169. *C. pandava*, Hors. Very common indeed. The form with confluent markings on the underside of the hindwing which is figured by deNicéville (Fig. 188, Plate XXVII, Vol. III) as the d.s.f. of this insect is not exclusively so in Burma. The usual d.s.f. is very similar to the w.s.f.. but is a little darker below. The form with confluent markings occurs also in some places, but much more rarely. I have specimens of it from Tharrawaddy, Henzada, and from an elevation of 3,000 feet in the Pakkoku Chin Hills (South Chin Hills).

170. *C. cnejus*, Fabr. Only four examples taken. It is rather easy to confuse it with *Everes argiades* at first glance.

171. *Tarucus theophrastus*, Fabr. I have two specimens from Henzada in May and from Prome in July 1909. It doubtless also occurs in Tharrawaddy but seems rare.

172. *T. plinius*, Fabr. Very common everywhere.

173. *Castalius rosimon*, Fabr. Common throughout the district.

174. *C. ananda*, de Nec. I have obtained 3 specimens, Konbilin stream on 10th February 1912, Tonkyank stream on 6th February 1913 and Thonze Reserve on 4th May 1912.

The only previous record of this insect in Burma appears to be contained in Watson's list of butterflies from the North Chin Hills published in Vol. x, page 634 of this Journal.

175. *C. roxus*, Godsat. A few specimens from some evergreen jungle on the Myaung stream in July 1911 and three from the Mokka stream in January 1912.

176. *C. decidia*, Hew. I got this at low elevations in Henzada so it should occur in Tharrawaddy, but I never found it.

177. *Niphanda cymbia marcia*, Few. This, if it may be so expressed, is one of the rarities that turn up fairly often. In all I have got six in Tharrawaddy; one from evergreen forest at the source of the Mokka stream on 21st January 1912, one from the Takawpi stream on 3rd February 1913, and four from the Taungnyo stream in 1909.

Elsewhere I found it commoner in the Pakokku Chin Hills at about 1,000 feet, and I have it from Maymyo.

178. *Lycænesthes emolus*, God. Fairly common and often found on wet sand by jungle streams.

179. *L. lycænina*, Felder. Not nearly so common as the last.

180. *Nacaduba viola*, M. One specimen from the Kyanktada hill, 2,640 feet, on 16th November 1911.

181. *N. kerriana*, Dist. Seven specimens from the same hill and on the same date. This species seems to be a Malayan one, and to be somewhat out of place in Tharrawaddy. I have it also from the foot of the Karen Hills in Toungoo.

182. *N. macrophthalma*, Felder. Three specimens of this from the same hill on the same date. On page 144 of Vol. III of his Butterflies of India, de Nicéville mentions an aberrational form of the male, from the Nilgiri Hills. I have seen this at the B. M. and I have specimens exactly matching it from Tharrawaddy (one from the Kyini Reserve). The blue colour on the upperside of all these aberrational insects is not the same as in typical *macrophthalma*, but is paler and nearer to the colour of *N. pavana*, Hors., of which species I should prefer to consider them aberrations.

I have what I take to be typical *macrophthalma* from two other localities in Burma. (Maymyo and Pathichaung in the Toungoo district.)

183. *N. pavana*, Hors. I have what I take to be this insect from the Kanbalu hill, 2,600 feet, on 2nd February 1911 and from Myanle on 29th March 1911.

184. *N. dana*, de Nec. The male of this is quite common, being usually found on wet sand, but the female I have not yet found.

185. *N. nora*, Felder. Also common, and frequently found in company with *dana* on wet sand.

186. *N. noreia*, Felder. Not very common.

187. *N. cœlestis*, de Nec. I have obtained seven, all males on various dates in January, February and September.

188. *N. atrata*, Hors. I do not seem to have got this, but I should have it.

189. *Lampides bochus*, Cr. Common, usually in streams in the forest.

190. *L. pura*, M. } Both occur, *celeno* most plentifully.
191. *L. celeno*, Cr. }

192. *L. elpis*, God. Fairly common, but the rarest of these four Lampides in Tharrawaddy.

Poritiinæ.

193. *Poritia hewitsoni*, M. In the Tharrawaddy District I have taken three insects that I take to be this, (10th February and 21st March 1912), but they are not constant among themselves and they all three differ from my other specimens in the possession of a large, isolated, black mark in the blue area in interspace 1 of the fore wing. All three have very little in the way of blue apical spots, and one has a broad black submarginal band on the hind wing, upperside, reaching from the anal angle to vein 4. These, however, would appear to be typical *hewitsoni* as they agree with Moore's description as given by de Nicéville.

I am considerably puzzled over *P. hewitsoni* and *erycinoides*. It seems easy to divide the males among these two species, *hewitsoni* being recognized by its greener colour, its black cell and the small sub-apical blue marks on the forewing. The distribution seems curious; I have the following:—

3 males from Tharrawaddy, elevation 800-2,000 feet.
2 males and 2 females from the North Shan States at low elevations.
1 male from Manipur.

The males from the Shan States and Manipur lack the solid black mark in interspace 1.

Of *erycinoides* I have:—

A quantity from Maymyo (3,000 feet) both sexes.
A long series from Thandaung (Karen Hills, 4,200 feet) all males.

Of the Maymyo females, (one pair was taken in Coitu) there are two kinds, those with and those without orange streaks on the upperside of both wings.

Thus nowhere have I found the two flying together, and if anything *hewitsoni* would seem to be the low level (or Assam) form and *erycinoides* the high level (or Malayan) form.

194. *P. phalia*, Hew. Two specimens from the Kyanktada hill, 2,640 feet, on 16th November 1911.

195. *P. phalena*, Hew. One specimen from the same hill on the same day which agrees exactly with the description of *Harterti*, Doh.

196. *Curetis bulis*, Db. and Hew., Common. The form occurring is *malayica*, Fd., and has a white female.

Thecinæ.

197. *Ilerda epicles*, God. One good female specimen from the Takawpi stream on 3rd February 1913. In Tharrawaddy this insect must reach its southern limit.

198. *Aphnæus syama*, Hors. This is local in Tharrawaddy, but I found one spot where it was plentiful. The insects alighted on tall blades of grass, as *ictis* also does, and were of the form called *peguana*, M.

199. *A. lohita*, Hors. One specimen of this, 3rd February 1913. *A. ictis*, Hew., does not seem to occur, but I have a specimen from Henzada taken in March at an elevation of 3,800 feet. This appears to be typical, but a long series obtained in the North Shan States in March and April is not as the orange patch on the fore wing is much smaller and the area glossed with blue is larger.

Arhopalinæ.

200. *Mahathala atkinsoni*, Hew. I found these common, when I had no net with me, by the Mimbu stream in July, flying around lopped trees and

shrubs in the plains beside the stream. Later I got some, all battered. Again I saw it, apparently fresh, near Sanbok village on 15th February 1912.

I have *M. ameria* from Henzada.

201. *Iraota timoleon*, Stoll. I have obtained one male from the Kyauktada hill, 2,600 feet, on 16th November 1911, where it was flying in company with more numerous *I. rochana*. I also got a female which came into the rest house and was there taken on the wing at Nyanle in the Taungnyo Reserve on 30th April 1911.

202. *I. rochana*, Hors. Four males from the Kyanktada hill as above and two more from the Kaubalu hill, 2,600 feet, on 20th November 1911, I have a female from the Gokteik viaduct caught in July 1913.

These captures extend the range of what seemed like a Malayan insect, and Col. Tytler further records it from Manipur.

203. *Amblypodia anita*, Hew. Rare. I have only got one male from an evergreen stream in the Thonze Reserve, 3rd May 1912.

204. *Surrendra quercetorum*, M. Not common. From the Bawbin Reserve, 1st February 1911 and at Prome on the hill in July.

205. *Arhopala centaurus*, Fab. Fairly common in the evergreen or "Indaing" jungle. December 1912. Kadin Bilin, February 1913, Sanbok, 15th February 1913.

206. *A. amantes amatrix*, de N. Very common in the beds of streams where it often settles on a willow-like shrub that grows there (*Hoya*).

207. *A. bazalus*, Hew. One specimen in the plains in country that is inundated during half the year, Kyankwa, 25th May 1912. An unexpected locality for an Arhopala.

208. *A. atosia arici*, Std. I obtained six examples of this in some evergreen jungle on the Thabelu stream, Thonze Reserve, in May.

209. *A. eumolphus farquhari*, Dist. A single specimen from the same stream in May.

210. *A. hewitsoni*, B.B. This is very common in the "Indaing" jungle, settling on the broad leaves of the trees.

211. *A. toungura*, Gr. S. Common in company with the last named in "Indaing" jungle. The female is a much paler blue than the male. In Tharrawaddy I chiefly got the blue female but in Henzada I got mostly the purple male, from similar jungle. There are two distinct kinds of *A. toungura* and they probably merit names as they certainly represent constant forms, and may be two species. The males from wet jungle are darker, both in the blue colour of the upper side and in the ground colour below. The underside is also washed with pink. The females differ below in the same way and on the upperside much more resemble the colour of the male but females can always be distinguished by the extent of the blue colour. This darker form inhabits wet and evergreen jungle, while the other form inhabits dry "Indaing" forest and is paler both above and below with scarcely any pink wash below.

I have the dark variety from Rangoon and the Lower Thaungyin, the pale variety from Tharrawaddy, Henzada and Toungoo.

From Rangoon I have one female of the dark kind which possesses a dull green fore wing, the corresponding wing being blue as usual, with just a dusting of green scales in interspace 1*a*.

212. *A. aberrans*, de N. I have this from the Taungnyo Reserve. Also from Henzada.

Deudorigina.

213. *Deudorix epijarbas*, M. One male from the Kyanktada hill, 2,600 feet, on 16th November 1911.

214. *Virachola isocrates*, Fabr. One male from the Kyanktada hill, 2,600 feet on 16th November 1911, and another from the Yoma top in the Thonze Reserve on 1st May 1912. A female from the Bawbin Reserve on 5th April 1911.

215. *V. perse*, Hew. One male each from the Kyanktada and Kanbalu hills, 16th and 20th November 1911, elevation 2,600 feet.

216. *Rapala schistacea*, M. Not very common. Obtained on 14th April 1912. Seems to fly at all times of the year.

217. *R. petosiris*, Hew. I have records from the Bawbin Reserve on 3rd April 1911, Taungnyo Reserve on 3rd May 1911 and from other places at various times from March to November.

218. *R. suffusa*, M. This is less common and I have it from the Mokka Reserve on 8th January 1913.

219. *R. jarbas*, Fab. Quite common in stream beds, March to May.

220. *Camena icetoides*, Elw. Four specimens that I take to be this form from the Kyanktada hill, 2,640 feet, on 16th November 1911.

221. *Tajuria jangala ravata*, M. Common from March onwards.

222. *T. maculata*, Hew. Two males from the Kyanktada hill, 2,600 feet, on 16th November 1911 and one female, which is smaller, from the Taungny Reserve on 12th February 1911 at an elevation of only 200 feet.

223. *Hypolycaena erylus*, God. Both sexes are fairly common, and come to wet sand, 14th November 1911, 25th January 1911, 9th May 1911.

224. *Chliaria othona*, Hew. Not common, but now and again to be met with in moist streams, 7th February 1912, 10th April 1912 and 3rd May 1912, one female only.

225. *C. merguia*, Doht. From the Thonze Reserve on 4th May 1912 and the Mokka Reserve on 6th January 1913. On the latter occasion it was flying round some blue flowers beside the stream and I mistook it for *Z. etolus* or I could have got more than 4.

226. *Biduana melisa*, Hew. Twice in May 1912 in evergreen forest in the Thonze Reserve.

227. *Cheritra freja*, Fabr. Not very common in Tharrawaddy, but I have notes of it from the Mwegyi stream, Taungnyo Reserve, on 18th April 1911 and from the Thonze Reserve on 6th May 1912.

228. *Zeltus etolus*, Fab. Scarce in Tharrawaddy.

229. *Loxura atymnus*, Cr. Common in long grass, 3rd March 1911, April and May.

230. *Charana mandarinus*, Hew. Only from the Kyanktada hill, 2,640 feet, on 16th November 1911; two.

231. *Catapaecilma elegans*, Druce. Four males from the same hill on the same day.

232. *Horaga moulmeina*, M. Three, again from the same hill on the same day. I only spent one day on this hill top, but in practically the one spot I made a bag that I shall never forget and probably never equal, so many rare insects did I find there. I never got a chance to repeat the visit.

HESPERIDÆ.

Heperiinæ.

233. *Celænorrhinus leucocera*, Koll. 1st February 1913, two.

234. *C. munda*, M. Occurs.

235. *C. chamunda*, M. Took the male.

236. *C. affinis*, Elw. and Edw. The male.

237. *C. aurivittata*, M. Bilin Reserve, 12th February 1913 and Taungnyo Reserve, 14th February 1911.

238. *Coladenia indrani uposatha*, Fruh. A few.

239. *Ctenoptilum vasava*, M. Sanbok village, 16th February 1913.

240. *C. multiguttata*, de Nec. Bilin Reserve, 4th February 1913, Six.

241. *Odontoptilum angulata*, Fd. Thewa Reserve, 2nd March 1913.

242. *Caprona syrichtus*, Feed. Common in all forest.

243. *C. ransonnettii alida*, de N. A single male. This was common in the North Shan States.

244. *Tagiades atticus*, Fabr. (formerly *ravi khasiana*). This was common and I have specimens as follows:—Mokka, 14th January 1913. Tharrawaddy, 14th June 1912. Tanbingon, 25th December 1912. Taungnyo Reserve, 12th February 1911. Bilin Reserve, 28th January 1911, Kyini Reserve, 21st February 1913.

245. *T. obscurus meetana*, M. (formerly *alica*). I have this from the Taungnyo Reserve, February 1911.

246. *T. litigiosa*, Mosch. Thonze Reserve, 5th May 1911.

247. *T. pinwilli*, But. Occurs.

248. *Satarupa bhagava*, M. Kyini Reserve, 22nd February 1913.

249. *Sarangesa dasahara*, M. Tanbingon, 25th December 1912. Mokka Reserve, 12th January 1913. Bilin Reserve, 6th February 1913. Thonze Reserve, 3rd May 1913. Common.

250. *Sancus pulligo subfasciatus*, M. Seywa, 2nd January 1913, and Bilin Reserve in January.

251. *Astictopterus henrici*, Holland. Byanle.

252. *Koruthaialos xanites*, But. Bilin Reserve, 30th January 1913.

253. *Suada swerga*, de Nec. I have this.

254. *Suastus gremius*, Fabr. and this.

255. *Taractrocera mævius*, Fabr. Not taken but it must occur.

256. *Jambrix salsara*, M. Seywa, 3rd January 1913.

257. *Aeromachus indistincta*, M. Sanbok, 16th February 1913, Mokka Reserve, 14th January 1913. Common, in company with *T. mævius* usually, on the heads of a yellow flower of the order, compositæ.

258. *Sebastonyma dolopia*, Hew. Occurs.

259. *Hyaratis adrastus*, Cr. Tanbingon, 25th December 1912.

260. *Arnetta atkinsoni*, M. Mokka Reserve, 8th January 1913. Bilin Reserve, 31st January 1913. Kyini Reserve, 22nd February 1913.

261. *Scobura cephala*, Hew. Bilin Reserve, 3rd February 1913.

262. *Gangara thyrsis*, Fabr. I bred a lot from a caterpillar covered with a white fluffy excretion that I found rolled up inside leaves of *Calamus erectus* in my garden in Tharrawaddy. There appeared to be two distinct broods in the rains.

I also saw the insect on the wing in Rangoon, outside the Pegu club in July.

263. *Matapa aria*, M. Common in the jungle all the season. Noticeable for its red eyes. Taungnyo Reserve, 14th February 1911. Pegu Yoma, 1st February 1913. Bawbin Reserve, 1st February 1911. Mokka Reserve, 12th January 1913.

264. *Kerana diocles*, M. Mokka Reserve, 14th January 1913.

265. *Notacrypta feisthamelii*, Bdl.

266. *N. restricta*, M. Mokka, 10th January 1913.

267. *Mdaspes folus*, Cr. Pegu Yoma, 6th April 1912. Fairly common.

268. *Cupitha purrea*, M.

269. *Telicota bambusæ*, M. Very common. Bilin Reserve, 31st January 1913—4th February 1913.

270. *T. dara*, Koll. Also common. 1st February 1913.

271. *Halpe zema*, Hew. Mokka, 10th January 1913. Bilin, 6th February 1913.

272. *H. moorei*, Wat. Occurs.

273. *H. burmana*, Swink. Occurs.

274. *H. sikkima*, M. Occurs.

275. *Iton semamora*, M. Also occurs.

276. *Parnara oceia*, Hew. Seywa, 4th January 1912. Bilin Reserve, 4th February 1913.

277. *P. mathias*, Fabr. Sanbok, 16th February 1913. Mokka Reserve, 10th January 1913.

278. *P. toona*, M. (=contigua).

279. *P. bada*, M.

280. *P. bevani*, M.

281. *Ismene mahintha*, M.

282. *Badamia exclamationis*, Fabr. Everywhere.

The foregoing list has been finished rather hurriedly during 10 days' leave from the front, but it does not seem much use to postpone it further. It represents captures during five seasons, as I was posted at Tharrawaddy from April 1909 until March 1913. In this time I visited nearly every part of the district and had one collector helping me, but I did not get as many chances of visiting hills on the Yoma top as I should have liked. The few visits I was able to pay to such hills were very prolific in their results.

I think one conclusion to be drawn from this list is that many types considered typically Malayan, may extend to the Pegu Yoma in suitable localities: they also extend further north along the foot of the Karen hills, and I have found *Cyrestis periander* at the Gokteik viaduct in the Southern Shan States. The map will explain the Districts.

THE GAME FISHES OF THE PERSIAN GULF.

BY

MAJOR W. H. LANE.

PART II.

(*Continued from page 748 of Vol. XXIV.*)

In the previous paper dealing with the game fishes of the Persian Gulf, it will be remembered that the merits and demerits of the surface feeders were fully discussed. The next group of fishes to which our attention will be directed is the

FLY TAKERS.

Every fly angler, whose heart is in the Highlands but whose duty, business or pleasure turns his footsteps to the Persian Gulf, will be delighted to learn that at Jask he can also indulge in his favourite pastime.

There is one species of fish that provides excellent sport with a loch-sized trout fly. His local name is a regular jaw-cracker, and was discarded from the very out-set. Now, among the upper angling ten at any rate, he bears the homely name of

THE TIDDLER.

This *sobriquet* has been handed down by each successive generation of military exiles, and doubtless the practice will be continued *ad infinitum.* But let us array him for once in all his cognominal glory. Here he is :—

Family = PERCIDÆ.

Species = *Lutjanus fulviflamma.*

The characteristics of this lively little perchlet could not be adequately portrayed by means of a photograph ; a description is therefore appended to assist identification.

Teeth.—Sharp conical teeth on both jaws, villiform teeth on vomer palate, and tip of tongue.

Eye.—Large and situated laterally, iris a brilliant yellow.

Fins dorsal.—There is one dorsal fin, but it is divided into two portions. The anterior portion is composed of 9 hard and sharp spines connected by transparent membrane. The posterior portion is rayed.

Pectoral.—Termination of pectoral reaches to about 1st third of black blotch on lateral line.

Caudal slightly forked.

Anal.—Three spines situated anteriorly, of which the third spine is distinctly longer than the second.

Lateral line.—Curves upwards from the gills and descends gradually towards the tail.

Scales.—Smallish in size and transparent.

Colour.—Back of a greenish hue and belly white ; caudal coloured yellowish green ; pectoral, pelvic and anal all golden ; five golden bars running longitudinally from gill plates to tail ; black blotch on the lateral line about ½ way between the root of the tail and edge of the gill plates.

The Tiddler is essentially a shore fish, and there are particular haunts round the rocky parts of Cape Jask, and in the adjoining creek, where *fulviflamma* is found in shoals. The difference in level between high and low spring tides is 9 feet, and it can therefore be readily imagined that it is essential to select a suitable state of the tide. At low tide the favourite holts are high and dry, and the Tiddler has sought other retreats : on the other hand at high tide the clefts in the rocks, behind the shelter of which the Tiddler lies secure from the buffetings of the waves, may be covered with six feet of water. In this case a trout-fly will probably not be seen. At about half tide, however, this game little fish will take a fly with aidity ; and, if the angler cares to work for a heavy creel, as many as 40 to 50 Tiddlers may be caught within the space of a few hours. Experience has proved that a dark-coloured fly is the most killing lure, such as the trout butcher, grouse and claret, alder, etc., but a winged fly would seem to be more attractive than a hackle, and in this connection it is interesting to note that a coch-y-bondu was absolutely despised.

The average weight of *fulviflamma* would be about three to the pound, but individual fish of ¾ lb. have been recorded ; it may be accepted therefore, without overstepping the mark, that the maximum growth of the Tiddler would be about 1 lb., and on a trout cast and fly a fish of even half this weight gives the sportsman a magnificent fight. In angling for Tiddlers one final word of advice is tendered—beware of the hamur. While playing a fish a hamur may also be watching the fun from his den, in which case if opportunity offers he will assuredly dash out and seize it. If such an incident does happen it is extremely unlikely that the Tiddler or trout fly will ever see the light of day again.

The question will probably be asked whether none of the species mentioned in the list of surface-feeders will take a fly. Experiments in this direction were never carried out, so that there is no practical basis on which to establish such claims. Other authorities, however, aver that the gar-fish (kharkoor of the Persian Gulf) can be caught on a fly. There would seem to be no reason to suppose that such species as the Susansir, Zayrpur, and small Saran should not rise to a salmon fly such as the Silver Doctor, or some other pattern that bears a shadowy resemblance to a white bait. In temperate waters the basses are fly-takers, and exploration in this field might prove that the "Surkhoo" or other species of genus *Lutjanus* would give the salmon angler the chance of keeping his eye and wrist in practice during the dog-days of enforced banishment in this Eastern Turkish Bath.

Let us now pass on to an examination of the characteristics of the last group of fishes in our table, *viz.*, the

BOTTOM-FEEDERS.

It is self-evident that no really hard and fast line can be drawn separating the surface from the bottom feeders. The pirao is essentially a surface feeder yet an occasional individual fish will be recorded by the locals when bottom-fishing ; similarly the giddie is one of the principal species caught bottom-angling though at times he will come to the gaff on a trolled bait. On the other hand, there are some species which, owing to the conformation of their anatomy, and the range of their habits, are essentially sand-grubbers. In the following pages we will confine ourselves to a review of those species which are unable, or which refuse, to take a trolled bait. The occasions on which the writer indulged in bottom-fishing were very rare, so that any dissertation on the relative sporting proclivities of the different species wlll be omitted. It may be taken for granted, however, that all those catalogued are game fish, and will afford sport to the fisherman whose particular bent is this form of angling.

Just as we found with the surface feeders, so it will be seen with the bottom-feeders that the family

CARANGIDAE

takes precedence.

The first caranx that presents itself for discussion is locally termed the

Kush.

Caranx ciliaris (?)

The following description was recorded from a specimen weighing 4 lbs.

Head.—Deep and compressed, mouth on the smallish side, but capable of considerable protrusion.

Teeth.—Villiform on both jaws, palatines, and whole upper surface of tongue extending to gullet, both above and below.

Eye.—Large and protruding, iris yellow after death.

Fins anterior dorsal.—Six sharp spines connected with transparent membrane.

Posterior dorsal.—Commences moderately close to termination of anterior dorsal, rayed and continued by a connected fringe up to a point distant from the root of the caudal equal to space between anterior and posterior dorsal ; the fringe terminates in a slightly elongated ray.

Pectoral.—Long, slender, narrow, delicate and graceful.

Pelvic.—Short and stiff and folding into a depression with anus situated at posterior end of this slot.

Anal.—Commences posteriorly to the anus at a distance equal to double the space between the anterior and posterior dorsals ; the initial ray is long and flexible ; the rays in the anal gradually shorten and the anal proper is continued towards the tail by a fringe similar to the posterior dorsal fringe ; it terminates also in a slightly elongated ray.

Caudal.—Rayed and deeply forked.

Scales.—Absent.

Lateral line.—Starts at upper termination of gill opening in an ascending curve descending to a point on the centre line about $\frac{2}{3}$rds length of whole body to fork of tail. It is ridged throughout, but becomes slightly keeled towards free portion of tail.

Body.—Deep and compressed.

Colour.—After death a band of steely blue commences above eyes and runs between lateral line and back up to caudal, broad at its commencement and tapering towards the tail. Above and below this band there is a space of brilliant iridescence. From the commencement of posterior dorsal to end of dorsal fringe, the space above this longitudinal band, is barred vertically from the base of each ray to the band with steely blue. Below longitudinal band and above lateral, line there is a row of large steely blue spots. Between the lateral and centre lines there are steely blue markings. Above the anal fin and fringe is a longitudinal band and transverse bars similar to the dorsal band and bars.

Remarks.—The maximum weight to which this fish grows would be about 12 to 15 lbs.

The next caranx of which observations were noted bears the local name of

Kobdar.

Caranx speciosus (?)

Weight of fish examined = $2\frac{1}{2}$ lbs.

The kobdar is very similar in appearance and conformation to the kush, but the following differences were remarked.

Head.—Much more convex.

Teeth.—Absent on jaws and palate.

Eye.—Relatively smaller and iris silver.

Marks.—The steely blue marks are similar to those on the kush, but in addition 7 broad bands run vertically from back almost to belly.

Colour.—There is more lemon yellow visible than on the kush, the cornea is tinged lemon yellow, likewise the cheeks, caudal, and all fins.

Remarks.—The maximum growth reached by the kobdar would be about 10 to 12 lbs.

Another caranx which is taken by the bottom angler is called by the locals

RUSHK.

Caranx armatus (?)

No actual notes were taken by the writer from a specimen of this fish, but almost every morning when the white bait nets were being dragged the rushk was obtained and these fish were casually examined and the prolongation of the first ray of the posterior dorsal was a feature that was particularly striking. The identification of these three species of caranx should be taken with reserve; but it is probable that the species to which they have been assigned will on further investigation prove to be correct. The rushk would attain a maximum weight of 12 to 15 lbs.

Although among the bottom-feeders the family of *Carangidæ* has been assigned the first place, by reason perhaps of the better sport which may be anticipated from its members, yet in point of weight of individual fish which will compose the average creel of the bottom-angler the family of

SQUAMIPINNES

will certainly play an important part.

Of this family the identity of one species has been determined; it is known locally as the

SHUNGOO.

Drepane punctata.

With this fish the hackneyed expression "once seen never forgotten" is peculiarly appropriate, as the general appearance of the Shungoo stamps him as a freak of nature for which no adequate reason can be assigned. The appended description will furnish the reader with a fair conception of the oddities of *Drepane punctata.*

Head.—Very deep and compressed. In front of the eyes is a very hard, long well-marked prominence, which gives this weird fish the appearance of being beetle-browed. There is a second much less prominent bump vertically above the eyes.

Eye.—Large and seated.

Nose.—There is quite a nose on this fish formed by a cartilaginous and bony plate which is continuous from gill plate to gill plate.

Mouth.—Is extremely curious. The mouth is quite small, but is capable of being protruded downwards to the extent of over an inch in a fish of 3 lbs. weight. The mouth of a shungoo of this size will just accommodate one's little finger. A hard pad is situated on both upper and lower surfaces of the gullet which is furnished with sharp teeth.

Teeth.—Villiform on a cartilaginous pad on upper and lower lips, crushing pad on palate and back of tongue.

Fins anterior dorsal.—Six sharp spines of moderate length, connected by transparent membrane; this fin fits into a socket. There are two short and sharp spines situated anteriorly to this fin which might be considered to form an integral part of it.

Posterior dorsal.—Rayed and very much developed, the outer fringe forming a convex curve, the rays near the tail being shorter than those at the commencement of the fin.

Anal.—Is similar to the posterior dorsal transposed, though the rays are not quite so long, but equally developed. There are three very sharp stout spines just anterior to anal fin. The root of the tail is very stumpy, but the rays of the caudal are very well-developed.

Caudal.—Straight cut, but convex in the centre.

Pelvic.—First spine is hard but not sharp, remainder rayed, a peculiar flap of cartilage like the point of a triangular bayonet comes out of the fin-pit.

Pectoral.—Very slender and long, the tip reaching to the base of the posterior dorsal fin—a black patch in the fin-pit.

Lateral line.—Convex curve from top of gill plate to root of tail and slightly ridged.

Scales.—Small-transparent.

Colour.—General colour silvery; the upper half of the fish (specimen examined weighed 3 lbs.) is marked with black spots about the size of those on a pound trout.

General appearance.—A very deep and compressed fish, almost as deep as it is long; a line from the mouth along the belly and the first anal spine is practically straight.

Remarks.—Day gives the local name of this fish as follows:—

Belooch, Shuk: Arrakanese, Shengnaroët: Burmese, Nga-Shengua. The similarity between Shungoo and Shengua (for "nga" in Burmese merely means fish) is most striking. Can it possibly be a mere coincidence that two countries situated so far apart as Burma and Persian Mekran should each call the same fish by a name that is almost identical? Such a contention is inconceivable. It is a problem that should be of more than passing interest to the Etymologist; more so as the intermediate Tamil and Telegu names bear no resemblance whatsoever to the Burma-Mekran root. The maximum weight to which the shungoo grows would be about 5 lbs.

Another fish which is extremely common in Jask waters is termed by the locals

SUNGSER.

Holacanthus xanthurus (?)

The identity of this species has not been fully established, a detailed description of a specimen is therefore appended.

Weight.—3 lbs. 10 oz.

Length to tip of tail.—1 ft. 8¼ inches.

Girth.—14 inches.

Head.—Is remarkable for a prominent lump a little distance behind the eyes.

Eye.—Large, iris iridescent, in some lights sky blue, in other lights olive green, shot with yellow.

Teeth.—Villiform rows on the upper and lower jaws; they are entirely absent on the tongue and palate. The upper and lower portions of the gullet are composed of a moveable cartilaginous pad almost like very fragile and porous bone. These crushing pads support on their anterior edge an upper and lower strip of sharp villiform teeth. The remainder of both upper and lower pads is studded with hard conical teeth, some of which are more dome-shaped than conical. The inner edge of the gill situated anteriorly is furnished with soft projections (combings) surmounted by villiform teeth.

Fins anterior dorsal.—Composed of 8 very strong and stout spines widely separated and connected by a thin transparent membrane. The extremities of the spines are extremely sharp. Protruding anteriorly from the base of the first spine are 2 thick sharp spines unconnected with membrane, that situated anteriorly is about ½ an inch in length; the second is about 1 inch in length. The whole of the anterior dorsal folds down in a well defined groove in the back.

Posterior dorsal.—Commences immediately where the anterior dorsal terminates. They can be regarded as 2 distinct fins. Situated anteriorly is a single hard spine, followed by 14 soft rays in juxtaposition connected by a thin membrane.

Caudal.—Nearly square-cut, rayed and powerful.

Anal.—Posterior portion rayed and soft. Anteriorly are three spines, the first is a comparatively thin spine with an excessively sharp point. The second is an extremely thick and stout spine of moderate sharpness. The third is a sharp stout spine about ½ an inch in length.

Pelvic.—Rayed and transparent, the anterior ray is continued for about ½ an inch by a soft whitish filimentous piece of cuticle terminating in a delicate point. Anteriorly is situated a hard spine.

Pectoral.—Of moderate length, soft, rayed and transparent.

Colour.—Head iridescent, general colouring being olive green. This hue is carried along the back to the tail. The sides are silvery and iridescent, towards back olive green, gradually merging into light gold towards belly which is white. The colour of the tail is most distinctive. From anal fin to the commencement of caudal is bright gold which continues along bottom edge of caudal and terminates in a patch of colour between gold and orange ¾ of an inch deep by about ½ an inch broad. The region of about 5th and 6th rays both on the upper and lower lobes of the tail are tinged pomegranate. The inside of the gill plates are remarkably coloured bright gold. The skin on the neck bordering the gills is an olive green turning into a bright gold where it merges into the mucous.

Scales.—Transparent and of considerable size. The head is scaled as far as the eyes.

Lateral line.—Well-defined curving upwards from the gill-plates and descending gradually towards the tail.

Remarks.—The maximum growth attained by the Sungser is probably about 6 lbs.

There is yet another bottom-feeder which figures largely in the catches of the villagers and he swims under the local name of

TENGUN.

Family undetermined.

The following description was most carefully recorded from a specimen, but all efforts on the part of the writer to settle the identity of this fish have signally failed.

This failure may be attributable to lack of accuracy in observing the specific points but in any event the notes as originally jotted down are here reproduced.

Body.—Extremely convex and deep.

Eye.—Large.

Teeth.—Absent on jaws; hard crushing plates on upper and lower surfaces of gullet.

Fins dorsal.—Soft and rayed, fin proper is long and curved backwards, and continued to free portion of tail by a connected fringe.

Caudal.—Deeply forked and long.

Anal.—Situated immediately below dorsal; rays are not so long as those in dorsal, and continued tailwards by a fringe similar to the dorsal fringe.

Pectoral.—Short soft and rayed.

There are no spines anywhere.

Colour after death. Flanks tinged with light gold from tail to head including gill plates; pectoral greenish yellow; pelvic distinct lemon yellow; anal and as far as anus, which is ½ way between anal and pelvic, bright lemon yellow; fringes tipped yellow green; lower parts pomegranate; caudal tipped yellow green.

Lateral line.—Curved slightly upwards from gill plates and gradually descends to tail.

Scales.—Small, and skin thick.

Remarks.—The tengun's maximum weight would be about 6 lbs.

Let us now proceed to the investigation of a variety of sea-fishes which is familiar to most of us by name both in temperate and tropical waters. Reference is made to the breams. Day divides the family of

SPARIDÆ

into 6 genera, of which two are represented at Jask. The most common genus is

PAGRAS,

and this genus possesses only one individual species in Indian waters which is locally termed the

COOPER.

Pagrus spinifer.

The following description will serve to fix the identity of this bream.

Weight.—5 lbs.

Length.—From tip of nose to cleft of fork in caudal 1 ft. 7½ inches.

Head.—Large. There is a characteristic protruberance in some fish on the median line between the eyes. According to local report this bump is peculiar to the male fish.

Eyes —Large.

Teeth.—Two rows of conical teeth on either side of both the upper and lower jaws. In addition 4 conical incisors in front on both jaws absent on palate.

Fins-dorsal.—Is divided into two portions; anterior portion consists of 10 spines connected with transparent membrane, the posterior portion consists of 10 connected rays.

Caudal.—Forked, span about equal to ⅓ of length of fish.

Anal.—Three spines anteriorly remainder rayed.

Pectoral —Narrow and remarkably long; first spine which is exceedingly stout almost equals span of caudal.

Pelvic.—Narrow and slightly more than ½ span of caudal.

Lateral line.—Is well-defined.

Scales.—Small and transparent.

Colour.—The head has a gilt sheen overlying a pinky red hue, which extends along the back to the tail; the dorsal and caudal is edged brick-red

Remarks.—The cooper is only a cold weather visitant to Jask, and when the angler happens to strike a shoal the fun is fast and furious. The maximum growth to which this fish attains is probably 15 lbs., but a 10 lbs. fish is a fine specimen. On occasions when the report spread that the cooper were in, a party of anglers would organize an outing in the cutter; and the picnic would also be enlivened by the presence of eight or ten villagers in their dug-outs. The capture of a cooper was known to one and all by the sound of its being banged on the head with an improvised "priest."

After dark when sport was slack the members of the party in the cutter would amuse themselves by beating one of the cushions violently every few minutes! This continual hammering was usually a sure "draw" for the locals. One by one they would up anchor and row in closer to the cutter until it was ringed with a circle of dug-outs. The hoax would then be disclosed, and the victims would join heartily in the general laugh! The party in the cutter, which would probably comprise as many as 9 hand-lines, would frequently bring back during an evening's jaunt between 30 and 40 coopers, averaging from 5 to 6 lbs. each.

The second species of sea-bream which the bottom-angler may encounter is a member of the genus *Chrysophrys*, and in local parlance is the

DUKH MULLAH.

(Mullah's daughter)

Chrysophrys haffara.

The following description was taken from a specimen weighing 1 lb. 9 oz.

Head.—The median line from nose to fore-head is straight, neither convex nor concave.

Mouth.—There are distinct upper and lower lips which are non-prehensile.

Teeth.—Are characteristic; at extremities of upper and lower jaw are four conical incisor teeth placed at the same angle as those of a rodent or very old horse. They are of considerable length and thickness and are set in tissue resembling very much the gums of a human being. On each side of the upper jaw are four rows of dome-shaped crushing teeth, and 3 corresponding rows on each side of the lower jaw. The gullet is provided with a pad above and below supporting sharp villiform teeth.

Eye.—Large, immediately in front of each eye is a prominent bump; iris bright gold.

Fins—dorsal.—Consists of one fin divided into two portions. Anterior portion is composed of 11 exceedingly sharp and strong spines connected by transparent membrane, the first is very short, the second is also short and about ½ the length of the third spine; the remainder are prominent; the anterior portion fits into a groove in back.

Pectoral.—Rayed and of medium length.

Pelvic.—Of considerable size, rayed, except exteriorly where there is a strong, hard and sharp spine.

Anal.—Consists anteriorly of one small sharp spine, followed by a long and very stout sharp spine, and a third spine not so stout, but equally sharp. The remaining portion is rayed.

Caudal.—Forked and rayed.

Colour is distinctive. A broad splash of bright gold under each eye connected across bridge of nose by bright gold band; dorsal fin bright gold; caudal orange tipped with bright gold. Pelvic fin is black, streaked with milky white; posterior portion of gill-plates bluish-black; sides and belly a net-work of bluish-brown on a milky white back-ground.

Lateral line.—Curves upwards from top of gill-plate and gradually descends to tail: it is very slightly ridged.

Remarks.—This fish is by no means common. Like the cooper its flesh is excellent for table purposes. Its maximum growth would probably be about 6 lbs.

We have now arrived at the last family on the list of bottom feeders, *viz.*, the

PERCIDÆ.

Of this family two genera are represented, each by one individual species. The first species termed locally the

KHER.

Lutjanus roseus.

Has already been described in works dealing with Indian fishing; a repetition will therefore be eschewed. The kher is very similar in colour and conformation to the surkhoo—*Lutjanus argentimaculatus*—but it can be distinguished readily from the former by reason of its rounded caudal, the caudal of the surkhoo being forked. The following measurements were recorded from a specimen caught by a local in his net.

Weight—38 lbs.

Length—3ft. 9½ inches.

Girth—26¾ inches.

The maximum weight to which the kher attains would probably be about 60 lbs.; it will be seen therefore that this species grows to much larger dimensions than its congener the surkhoo.

The second bottom feeding perch bears the local cognomen of

BAHILOOL.

Serranus miniatus.

Mouth.—Lower jaw is under-hung and powerful.

Teeth.—Extremity of lower jaw is furnished with 2 sharp conical teeth, the upper jaw is similarly provided but the pair of conical teeth are somewhat separated.

Both upper and lower jaws support several rows of formidable villiform teeth, a cluster of similar teeth on the vomer, absent on tongue which is well developed. There are small villiform teeth on both surfaces of the gullet and on the gill fringes.

Eyes.—Small, sunk, iris tinged with gold.

Fins dorsal.—Is divided into 2 portions; anterior portion comprises 9 stout sharp spines connected by transparent membrane; posterior portion rayed and markedly pointed at its extremity.

Anal.—Immediately below posterior portion of dorsal and similar to it in character; anteriorly 3 stout spines.

Pectoral.—Half fan-shaped.

Pelvic.—Immediately below pectoral, exteriorly 1 hard spine.

Caudal.—Long, rayed and rounded.

Scales.—Small.

Lateral line.—Slightly ridged.

Colour.—Jaws, inside of mouth, and tongue deep crimson; general colour of body red—dorsal, anal and pelvic edged with crimson; pectoral crimson edged with a broad band of orange; whole of body, head, caudal and anal speckled with pale blue spots.

Remarks.—The maximum growth of this species would be about 5 lbs. It cannot be considered common in Jask waters.

With the bahilool terminates our investigation of the bottom feeding game fishes of these latitudes. There is a question, however, on the tip of the tongue of the angler who has heaved a lead over the gunwhale on a summer's night off the coast of the Emerald Isle. Do the waters of the Persian Gulf harbour any of the skate family? In parliamentary language the answer is most emphatically in the affirmative. But when all is said and done can a skate be appropriately admitted to a place in the piscine aristocracy? Hardly so—although in some localities in the western hemisphere fishing for skates is included in the realms of "sport." In any event the skate or *pao* is present in swarms and any estimate of his maximum weight is pure guess work.

One sportsman is credited with a fight of some 6 hours duration with a monster skate; at the end of which time the line parted. 200 lbs. would certainly be no exaggeration. Before leaving the subject of the *Trygonidæ* one word of caution is offered. In handling a skate let the novice be exceedingly careful of the spine below his whip-cord of a tail. A prick from this weapon of defence, and he is an adept in its use, may develop into an exceptionally unhealthy sore. In addition to the skate the creel of the bottom-angler may be varied by the capture of an occasional *soos* (family *Rhinobatidæ*) familiarly known as the "ground shark"; and as for the "gulloo" or cat-fish, the angler is frequently obliged to up-anchor and change his *venue* to avoid the unwelcome attentions of this scavenger of the seven seas.

Up to the present only the game-fishes of Jask have been introduced to the prospective angler. Let us take a tour, on paper, round the Persian Gulf and delve, metapherically speaking, into the delights of

OTHER FISHING RESORTS

and see what treasures live beneath the surface of this vast arm of the Indian Ocean. Starting from Karachi and skirting the coast of British Mekran the prow of the packet is headed for

Ormara.

During the cold weather months, sport in the waters of Ormara is reported to be of the first quality, the principal fish being the surmai or seer. There is a tale told in the Gulf ports that a gigantic surmai leapt into the boat of a local fisherman, and striking the unfortunate wretch with his jaws in the pit of the stomach disembowelled him. Such a legend may savour of the proverbial fisherman's yarn, but anyone who has examined the mouth of a large surmai can readily imagine that it is not entirely beyond credence.

Pasni and Gwadar are the next ports of call on our voyage of discovery, but no definite information is forthcoming concerning their petentialities for sport with rod and line, though dried fish and sparks' fins would seem to form the main items of export. In normal times the slow mail will next drop anchor in

CHAHBAR BAY,

a large indentation in the coast of Persian Mekran.

The fishing at this tiny little British settlement, it must be admitted, is disappointing; saran there are during the hot months, but round the shores of the promontory they require a very large amount of coaxing. From local information it has been gathered that on the opposite side of the bight a distance of 8 miles, lie the favourite haunts of the saran, but the accuracy of this statement still requires to be put to a practical test. Passing the low-lying promontory of Jask, where the 100 fathom line curves within 3½ miles of the Cape, we steer to the mouth of the Persian Gulf proper, and drop our anchor at

HENJAM,

a small island about half way along, and lying close to the southern shore of the larger island of Kishim. In the Straits fish are to be caught though of what variety there are no authentic records; and in this connection the sportsman will have to take precautions as the tides run strong. Bunder Abbas, Linga, Bushire are other ports on the Persian Littoral, and the Shatt-al-Arab at the head of the Gulf has become famous within recent times. Still continuing round the Arab coast, we may touch at Bahrein, the centre of the pearl industry, and continuing over the Great Pearl Bank, we once again pass into the tidal race at the head of the Gulf of Oman and seek refuge in one of the fjords of the

MUSANDAM PENINSULAR.

It is a problem which scientific research can only solve whether the true pelagic fishes enter the Persian Gulf proper or not. The author's personal opinion is that the limit of their western migration is the Peninsular of Musandam. Enquiries have been instituted, and omitting Bushire the ports mentioned have all been visited on two separate occasions at an interval of 26 months. In no single instance were there any indications that the great families of pelagic fishes penetrated into these regions. Is there any solid foundation on which this hypothesis can be based? A glance at the chart of the Persian Gulf proper will demonstrate the fact that, with the exception perhaps of one hole in the sea-bed south of Tanb Island, there are comparatively few soundings of over 50 fathoms, throughout the length and breadth of this enormous basin. Contrast this actuality with the condition that obtains in the Gulf of Oman. At a point 6 miles south-east of Cape Jask the sea-floor has sagged to a depth of nearly 1,400-ft. It has already been remarked that the pirao when hooked over this shelf *invariably* heads for the open sea. Is not this settled impulse proof positive that, in the throes of his struggle for life, instinct is driving him to seek refuge in his true home—the mighty deeps? Is it at all reasonable to contend then that he will voluntarily abandon this *habitat* assigned to him by nature and migrate into a comparatively shallow trap which the same nature by intuition tells him is but a blind alley? By some sceptics such notions may be labelled "fantastic". Does any one but a bigotted atheist deny that some power guides the fowls of the air in their annual migrations? Does not this self-same power then also pilot the fishes of the sea in *their* yearly migrations? But let us conclude our voyage by dropping anchor at

MUSCAT.

From the deck of the steamer, as we approach this port, the eye that is geologically inclined will discern at once that the Sultan's Capital is situated practically in the centre of what was at some prehistoric era a terrific volcanic upheaval. The crumbling slopes of the jagged barren bluffs drop sheer down into abysmal depths below. The fishing-grounds—and this expression is no Irishism—lie not in the harbours of Muscat and Muttra—few healthy game fish would frequent those polluted road-steads; the haunts of the true pelagic families may be looked for some three miles off shore. In these marine labyrinths the locals bottom-fish *and catch surmai* at an approximate depth of 60 fathoms! Here also roams the *geedur* of 100 lb. and the *sewa* and a host of other game fishes, whose identity is as yet undetermined. But lord of all these finny creatures is the world-famed sword-fish. There are records to shew that this Goliath has been hooked on rod and line, but unless the deeds of bygone anglers are being overlooked, never yet has this mammoth been brought to gaff by a western angler. "Tis better to have hooked and lost than never to have hooked at all" is perhaps some consolation to an angler, as it is reputed to be to the love-sick swain who has just been the recipient of a broadside from a super-virago. Still—the thought is bound to rankle—"if only I had ——— etc., etc." The day may yet dawn, however, when the record for the heaviest fish caught on rod and line in Indian waters may pass over the Gulf of Oman from Jask to Muscat.

From the foregoing dissertation the prospective angler should have derived a comprehensive idea of the sport that awaits him in the waters of the Persian Gulf. Let us therefore pass on to a consideration of the three remaining problems that were enunciated at the commencement of this paper.

METHOD TO BE ADOPTED.

SURFACE-FEEDERS.

For the surface feeders trolling is undoubtedly the best method of securing sport. The line should be marked with silk at every 50 yards, and 50 yards should be let out behind the boat. No lead is necessary or desirable, certainly within the 15 fathom line. The pace should be just as fast as the boat can be rowed with comfort. If a fish has touched the bait and dropped it, do not stop the boat. Carry on for a short distance and if nothing further happens keep the boat in motion and reel up slowly. As the lure approaches the craft it will skim along the surface of the water ; frequently this particular motion proves an irresistable temptation to the procrastinating rover. A final word of advice is tendered. Never under any pretext whatever, put the rod down in the boat while the bait is overboard. Such a procedure is merely steering a deliberate course to ultimate disaster.

BOTTOM-FEEDERS.

For bottom-fishing paternostering is the most efficacious method, and two booms are recommended, with a large specially designed sea-float. In this form of angling local knowledge is paramount. Each variety of fish must be wooed in its own special location. It is perfectly useless anchoring over the *sungser* beds and hoping to catch *coopers.* It is equally futile rowing out into the void and expecting to catch anything. The villagers have the different areas mentally fixed by crosscuts on prominent land marks. It is necessary either to engage one specially as guide and philosopher, or the other alternative is to join the merry throng that goes singing along somewhere about 2 a.m., and drop anchor in close proximity to the general conclave.

The third subject that presents itself for discussion is the question of

LURES.

It is a matter of common-sense to suppose that the natural food of the larger predacious fishes, if persented in a scientific manner, is likely to prove a far more deadly attraction than any manufactured imitation. It can therefore be readily deduced that an artificial lure should only be employed when natural bait is not procurable, or when the stock has become exhausted. It may be argued that difficulty will probably be encountered in procuring such natural goods ; but this contention is not applicable to the Persian Gulf. Arrangements can always be made with one of the villagers, and such will include the provision of a locally-made cast net of suitable mesh.

The natural *pabulum* of the surface-feeders consists of the minnows of the class *pisces* ; the varieties most commonly obtained will be described in detail.

MULLET.

Experience has proved that for general utility and in its killing properties the family of *Mugildæ* stands unrivalled. Of the mullets three species are common at Jask.

BOI (*pronounced* " *bo-i* ")

The bo-i is a tough silvery fish, which does not grow beyond about 7 inches in length, and can be distinguished by its comparatively narrow head, and by the fact that the posterior portion of the iris is coloured golden. It is in spawn in December.

BI-ACH.

The bi-ach (the "ch" being pronounced as in "*loch*") attains a maximum weight of about 4 lbs., but the smaller specimens up to 10 inches in length are suitable for bait. The bi-ach can be recognised by its broader and flatter head, and by the absence of the gold on the iris; its scales also differ from those of the bo-i being larger and coarser.

PITT.

This species of mullet is probably *Mugil waigiensis* and would grow to 10 lbs. at least in weight. One specimen of 7 lbs. was weighed and examined, and its measurements are quoted as such may prove of technical interest.

Length.—2 ft.

Girth.—14 inches.

In general colour the mature pitt is India-rubbery on back and sides, belly dull white and the pectoral is black. In the fry, however, the tone is much more silvery and the sides are marked with bands longitudinally. For purposes of bait however fish over 10 inches in length should be discarded.

TIR-MUKNA.

Occasionally the tir-mukna is taken in the cast net of the bait-catcher in company with the mullets and when, the angler can count one among his baits he may consider himself in luck's way. This fish is the "milk-fish" or "white mullet" of the Europeans in South Canara—family, *Clupeidæ;* species, *Chanos salmoneus*. The habits of this species are most remarkable. At certain seasons of the year the waters of the Persian Gulf are covered by extensive patches of a brick-red scum, about the origin of which there are several theories. In this scum shoals of large tir-muknas, up to 15 or 20 lbs. in weight, are frequently observed. On many occasions they were watched most carefully by the writer at close quarters from his dinghy. They swim about with their backs above water, and mouths wide open. It was a most striking phenomenon to see a wide-spread pair of cherry lips suddenly appear above the surface; in fact at times the apparition was quite uncanny. One can readily imagine how the mariners' tales of mermaids may have received their origin!

MORAN.

In the early pages of this paper the moran received cursory attention, and a promise was given that a description would be recorded in due course. Appended is the geneological tree of the moran; family, *Scombresocidæ*; genus, *Hemirhamphus*. In Jask waters two individual species are met with, *viz.*, *Hemirhamphus georgii* and *Hemirhamphus far*. Both species are somewhat similar in appearance, but *H. far* is deeper and is marked with 4 vertical black blotches on its sides which do not extend below the lateral bar; moreover in *H. far* the upper lobe of the caudal is bright yellow which characteristic is absent in *H. georgii*. *H. far* is solely a cold weather visitant; it vanishes with the advent of *H. georgii* to spawn in March. The conformation of the moran is unmistakable. The body is elongated and cylindrical and a longitudinal bar like quick-silver runs from gills to tail. The lower jaw of the moran is prolonged into a mandible very similar to that of a jack snipe. When some dozen specimens of a single variety of fish are used daily as bait for six months continuous fishing it must be acknowledged that a wide scope for observation has been acquired. At first the function of this mandible was not apparent, but when several individual fish were most carefully examined, and a slater-like crustacean was actually revealed in the process of being swallowed, its use became intelligible. The mandible is evidently employed for excavating the prey from the sand or perhaps from holes and crannies in the rocks. The mandible of *H. far* is shorter than that of *H. georgii.* The pace at which the moran travels in its aerial flights is scarcely conceivable. In the spawning season while the turmoils, which have already been alluded to are at their zenith, the moran is driven into a state of blind panic. It is possible that when it is indulging in one of its atmospheric excursions the sense of vision becomes exceedingly restricted, if not actually eliminated, for it will invade the boat in swarms. The velocity with which a moran strikes the angler in the neck, arms or chest cannot be realized until it has been experienced ; and in this connection the fisherman is in some danger. A blow in the eye from the mandible of a moran would unquestionably cause the loss of that organ. The author can certify that a case was admitted to hospital in which a sepoy while bathing had the drum of his ear perforated by the flexible mandible of a moran.

From March to August or September the moran forms the standard bait as the mullet is somewhat difficult to procure.

SARDINE.

At Muscat the sardine is the bait most commonly used, and it attains a considerable size ; on the Mekran side of the Gulf of Oman, however, this lure is not employed unless all other species of natural baits have proved unprocurable. It possesses one great disadvantage as a lure, in that its flesh is soft and in consequence it is easily torn off the hooks.

FLYING FISH.

The last of the lures for the surface feeder is the flying fish ; but it is pure chance whether a specimen is secured or not. This lure is naturally more effective in the open sea than it is on the shallows.

BOTTOM-FISHING.

The lure available for bottom-fishing is of two varieties. A small fish like an anchovy is that most commonly employed, but it can be alternated by the use of the ordinary

CRAB.

Two varieties of crab can be obtained ; the rock crab is of a dark-green hue, and is tougher than his brother the sand crab whose garb is a dirty yellow. However, it is one thing to have a crab in a can, it is quite another thing to transfer it successfully to a hook. The manœuvre is an art in itself, and merits description. At the time of capture all the legs are broken off except one on each side. This drastic operation serves two useful purposes. It keeps the wretched victim alive, and it also prevents it effecting its escape. At the time of use the two remaining limbs are torn off ; then the point of the hook (size No. 1/0 is suitable) is inserted in each stump in turn, which is wrenched bodily out of the socket. The mutilated carcass is then heaved overboard !

If nothing else served to put any decent-minded angler off bottom-fishing surely this barbarous practice should suffice !

There now remains but one point for discussion and that is the question of

TACKLE.

It is a most astounding fact that if a prospective purchaser enters almost any shop, and asks for sea-tackle, he will be shewn what can effectively be described in two words ABSOLUTE RUBBISH. One can only marvel why such down-right trash is ever manufactured, but presumably a market for it *does* exist, otherwise the trade would die a natural death.

Quite recently a nephew of the writer, *aetat* 10, sent him a calendar inscribed with the following moral:—

"*Keep your temper, it is worth more to you than anyone else.*"—The probable outcome of the next meeting with this self-same nephew is no fit subject for this paper! However, this excellent precept is passed on to other followers of the Gentle Art, not from any personal motive, but purely with the object of emphasising the fact that if the angler in the Persian Gulf wishes to keep his temper and *enjoy* his sport he must rigidly eschew the purchase of any of the rubbish that is proffered under the title of "sea-tackle." There is nothing so trying to the temper as being broken by every heavy fish. The advice therefore is tendered unequivocally, and it is based on the experiences gained from nearly 2 years of continuous angling—buy the best tackle that is to be had in the market. This plan, if adopted, will prove far less expensive in the long run, and the pleasure derivable from *catching* fish instead of *losing* them will amply repay the extra expenditure involved in the original outlay. From October to April inclusive heavy tarpon tackle is essential to success, whereas from May to September light tarpon tackle will prove sufficient to ensure the angler his much coveted and proverbial

TIGHT LINE.

THE BUTTERFLIES OF LAHORE

BY

G. W. V. DE RHE-PHILIPE, F.E.S.

In recent issues of the Journal, we have been given papers on the Birds of Lahore and on the Earthworms of Lahore. The butterfly collector is not much in evidence in the Punjab plains; but a list of the *Rhopalocera* to be found in Lahore, and its immediate vicinity may find interested readers, and will serve as a reference and aid to anyone who may wish to take up the study in the future.

The list is not a long one. For some months of the year—May to July and even later—the climate is exceedingly hot and dry, while a heavy and almost continuous dust haze lies over everything; and the winter months can be very cold. Conditions such as these are anything but encouraging to butterfly life, and it is only for a few weeks in September, October and early November, that these insects show up in any real numbers. For the remainder of the year they are either absent altogether or are represented by stray individuals of the more common and widespread species.

Under these circumstances, it is not surprising that so little attention has been paid to the Lahore butterflies. And yet, scanty as they are, they possess an interest of their own. Lahore was, not so very many years ago, a very dry sun-baked district; and the butterfly fauna had probably a close affinity to the types found in the desert tracts to the south-west. The spread of irrigation in the last decade or two has brought more humidity into the climate; and, while the old affinity to desert types still persists in some directions, it is not improbable that the changed conditions will, in course of time, facilitate the spread westwards of some of the species characteristic of the damper country to the south-east. We already have one or two not usually connected with a very dry habitat; and it may be that a local list compiled, say twenty years hence, will show a yet further change in the character of the butterfly fauna.

I may explain that the list below refers only to Lahore and its immediate neighbourhood, to which my collecting and observations during the last four years or so have been restricted. It may, however, be taken as typical of most of the eastern and central Punjab districts outside the influence of the submontane country to the east and north-east and of the pure desert to the south and south-west. The country consists of a flat alluvial plain, cut up at intervals by the rivers and their spill channels. The greater portion of the culturable land is under crops. Waste land is covered with scrub jungle—*Capparis* and *Salvadora*; and the trees (other than those introduced into gardens and plantations) are mostly the Tamarix, Sissoo, Acacia and occasionally a *Zizyphus*. Among garden shrubs which flourish and which are affected by the insects, either in the larval or the imago stage, may be mentioned the Oleander (*Nerium*), species of *Citrus*, the *Duranta* and a plant with white jasmine like flowers much used for hedges.

The list gives fifty-four species actually recorded; and mentions another fifteen or eighteen which should be or may be found to occur. The numbers quoted are those against which each species appears in Bingham's "Fauna of India" and in deNicéville's "Butterflies of India, &c."

NYMPHALIDÆ.

Sub-family—*Danainæ*.

As may be expected, this sub-family is poorly represented in the dry Punjab plains. Only four species appear.

1. *Danais plexippus*, Linnæus. (6 Bing.; 31 deN. as *genutia*). Is not rare in years when there is a good monsoon. It appears, as a rule, in July, and is on the wing throughout August and early September. A very occasional, and usually damaged, specimen may sometimes be seen during October, but after this the species disappears completely till the following rains.

2. *Danais chrysippus*, Linnæus. (8 Bing.; 28 deN.). To be seen throughout the year. Is very common during the rains and autumn, and only slightly less so in the winter. One or two may even be seen in the very hot months before the monsoon.

The variety *D. alcippus*, Cramer. (29 deN.) is to be taken but is extremely rare; the dimorphic form *D. dorippus*, Klug. (30 deN.) may possibly extend to the district, but I have not yet seen it.

3. *Danais limniace*, Cramer. (12 Bing.; 26 deN.). Appears at very much the same time as *D. plexippus* and is favoured by the same conditions. The species disappeared almost completely in 1915, but this was an extraordinarily hot year without rain. It was, on the other hand, exceedingly common in July and August 1916, which were unusually wet months. Is very fond of the flowers of the Duranta.

4. *Euplœa core*, Cramer. (31 Bing.; 61 deN.). Appears with *D. plexippus* and *D. limniace* and is nearly as common. An occasional specimen may sometimes be seen well into the cold weather.

Sub-family—*Satyrinæ*.

The conditions of the locality do not suit the sub-family and it is almost completely absent. Only two species have been found and individuals are scarce.

5. *Ypthima indica*, Hewitson. (172 Bing.; 214 deN.). Veryrarely seen, only two specimens being recorded, one in June and one in November. May possibly be more plentiful in favoured local spots.

6. *Melanitis ismene*, Cramer. (191 Bing.; 249 deN.). Very erratic in its appearances and not common then. My notes of the four years' observations show that a few were seen in 1913, one in 1914, none in 1915, while it was comparatively abundant in 1916. It is on the wing for a very short time only in August or September, and is markedly crepuscular in its habits.

The only other species of the sub-family at all likely to be found in the locality are *Mycalesis perseus*, Fabricius. (53 Bing.; 96 deN.), *Orsotriœna meda*, Fabr. (72 Bing.; 92 deN.) and *Ypthima asterope*, Klug. (173 Bing.; 213 deN.). I have, however, not come across any so far.

Sub-family—*Nyphalinæ*.

The sub-family is fairly well represented. The species are those usually found all over the plains in Northern India and individuals of each are, for the most part, common.

7. *Euthalia garuda*, Moore. (302 Bing.; 514 deN.). Only a single specimen—a female seen in September—has to be recorded and the species is apparently very rare in the locality. It was, as might be expected, the dry tract type I described in the 'Notes on some Butterflies from the Indian region' (Journal of the B. N. H. Soc., Vol. XX, page 759). The species will possibly, in the course of time, extend more commonly into the district from the west; and should probably be found more plentifully in places where the mango, on which the larva feeds, is grown.

8. *Junonia lemonias*, Linnæus. (371 Bing.; 347 deN.).
9. *Junonia orithya*, Linnæus. (372 Bing.; 350 deN.).
10. *Junonia hierta*, Fabr. (374 Bing.; 349 deN.).
11. *Junonia almana*, Linn. (375 Bing.; 344 and 345 de N.).

All the above four *Junonias* are more or less abundant in Lahore from July on till towards the end of the cold weather, frequenting gardens and open spaces. *J. orithya* and *J. hierta* appear, as a rule, rather later than the other two, never being much in evidence till the rains are well over. *J. hierta* is always the least common of the group; the other three are often to be seen in considerable numbers towards the end of and just after the rains, and stray specimens may be taken even in the coldest months.

12. *Vanessa cardui*, Linn. (376 Bing.; 520 deN.). The 'Painted Lady' appears regularly each year about the middle of November and is common throughout the cold weather, disappearing in February or March. It frequents gardens and open ground, and is particularly fond of flowers, chrysanthemums and yellow cosmos being always a great attraction.

13. *Hypolimnas bolina*, Linn. (397 Bing.; 419 deN.). This beautiful butterfly is comparatively common, being in flight only during the monsoon months, July to September and early October. Lahore specimens are invariably smaller than those found in the damper country of Bengal and the United Provinces; and the males always have light blue and white patches, the variety with very dark blue markings never being found.

14. *Hypolimnas misippus*, Linn. (398 Bing.; 420 deN.). Is distinctly less common than the last and has to be looked for. It appears later and remains on the wing a much shorter time. I have taken only one—the ordinary—form of female, but the other mimicking *D. dorippus* possibly also occurs.

15. *Atella phalanta*, Drury. (416 Bing.; 314 deN.). Never found in the abundance one is accustomed to elsewhere, but it appears regularly and several may be taken any year between August and early November.

It is not improbable that, in addition to the above, which have been actually recorded, an occasional specimen of *Argynnis hyperbius*, Johanssen. (435 Bing.; 421 deN.: as *niphe*, Linn.) may also be picked up.

PABILIONIDÆ.

The family is represented by three species only. One occurs very rarely, but the other two are common.

16. *Papillio aristolochiæ*, Fabr. (490 Bing.). Occurs but is very scarce. I have only seen one or two specimens each year, always in the monsoon months.

17. *Papilio demoleus*, Linn. (507 Bing.). Exceedingly common for the greater part of the year. It becomes scarce only for a few weeks during the very hot and the very cold months.

18. *Papilio polytes*, Linn. (=*P. pammon*, Linn.). (522 Bing.). Males appear about the time the first monsoon rains fall in July and gradually become common. Females are usually much later, seldom being in evidence before late August. The brood seems to die out by the end of October, though a few ragged specimens may sometimes be seen as late as the third or even fourth week of November.

PIERIDÆ.

A family more strongly represented than any other in this part of the Punjab. The species are fairly numerous and individuals of most are common, so that a large proportion of the insects to be seen at any time are always of this family. It is only during the blazing hot and hazy weather of late May and June, when hardly a butterfly is to be seen, that these whites are scarce.

19. *Delias eucharis*, Drury. (571 Bing.). I took a very battered specimen in August 1916—the only one seen during the four years. The species is common to the south-eastward and may yet extend more freely into the district in years to come.

20. *Anaphæis mesentina*, Cramer. (581 Bing.). One of the most abundant butterflies seen in and around Lahore during the cold weather. It appears about November and is common everywhere till February or March, may be seen in thousands in the scrub bushes alongside the Railway.

21. *Pieris brassicæ*, Linn. (590 Bing.). Another cold weather insect. Appears in November and is common during the few weeks following. Partially disappears in the very cold weather, to come out again for a short time in January and February.

22. *Huphina phryne*, Fabr. (604 Bing.). This dry tract form of *H. nerissa*, Fabr., is occasionally taken, but is rarer than might be expected. It is probably overlooked by reason of its general resemblance, when flying, to the more common *A. mesentina*.

23. *Ixias marianne*, Cramer. (608 Bing.). Very rarely in the monsoon months, July to September. There seems to be no reason why it should not be more plentiful.

24. *Appias libythea*, Fabr. (610 Bing.). A few may be seen, usually in the period between the end of the rains and the setting in of the cold weather. Never common, but it is possible that a superficial likeness to other Pierids results in their being overlooked.

25. *Catopsilia crocale*, Cramer. (622 Bing.). Both this and the variety *C. catilla*, Cramer, are common throughout the monsoon and autumn months when it swarms round the flowers of the *Duranta*. A few may be seen during the winter and early spring, but it is never common after October.

26. *Catopsilia pyranthe*, Linn. (623 Bing.).

27. *Catopsilia florella*, Linn. (624 Bing.).

Both of these are common, appearing about the same time as *C. crocale*, but in special abundance just after the rains.

28. *Colias fieldi*, Menetries. (638 Bing.). Not uncommon in the early cold weather months. Is also to be seen in February and March.

29. *Terias libythea*, Fabr. (640 Bing.). A few may generally be taken in October-November. The species was unusually abundant for a short period in the autumn of 1914.

30. *Terias læta*, Boisduval. (641 Bing.). Only one or two have actually been taken, in October after the rains, but the species is probably more

common than these limited captures would indicate. It is not always easy to distinguish between the various species of the genus when in flight, and *læta* is possibly often overlooked.

31. *Terias hecabe*, Linn. (643 Bing.). Always the most common of the group. To be seen flitting round hedges and about grass country between August and November, and the species never quite disappears till the end of the cold weather.

32. *Colotis amata*, Fabr. (648 Bing.). The form *C. calais*, Cramer, is to be found almost throughout the year, commonly between July and November, less frequently but always fairly regularly from November till April or early May. As a rule, flies low, close to the ground, and is difficult to see.

The form might well be treated as a separate geographical race of *amata*. It is appreciably distinct from the parent form and is very constant in its facies.

33. *Colotis protractus*, Butler. (649 Bing.). Never really common, but an observant collector would generally take a few, in suitable spots, between September and November. It is somewhat irregular in its appearances; and, till it has been taken and recognised in flight, is apt to be mistaken for the yellowish wet season form of *C. vestalis* which is very common.

34. *Colotis vestalis*, Butler. (651 Bing.). Exceedingly abundant during all but the very hot dry months of May and June, when it disappears, and during the cold of December and January when it is scarce. Very much addicted to flying in and out of and about hedges of *Duranta*, *Dodonea* and other shrubs.

35. *Colotis fausta*, Olivier. (652 Bing.). Very rare. Only a single capture recorded (October).

36. *Colotis etrida*, Boisduval. (654 Bing.). Appears between August and December. Is comparatively scarce in the gardens in residential Lahore, but fairly common about the shrubs in the open country round. I noticed the same avoidance of habited localities in Oudh (see note on the Butterflies of the Lucknow district, Journal, B. N. H. Soc., Vol. XIV., page 492).

In addition to the above actually recorded by me, the following may also occur :—

Ixias pyrene, Linn. (606 Bing.). Should occur ; and even if it does not, at present, might establish itself. It is common to the south-east, conditions in the Punjab are not unsuitable, and the food plant of its larva, *Capparis sepiaria*, is found everywhere.

Terias venata, Moore. (639 Bing.). Has been recorded from 'the Punjab.' I have looked especially for it in Lahore, so far without success.

Colotis phisadia, Godart. (650 Bing.). Has been taken at Multan to the south-west, and there is a chance of its being found nearer to and in Lahore. The records of its occurrence anywhere in India are, however, very scanty.

Pareronia hippia, Fabr. (659 Bing.). Common further south-eastward ; and as the food plants of the larva (varieties of *Capparis*) abound and conditions are otherwise generally suitable, the species will probably yet be found.

LYCÆNIDÆ.

The 'blues' to be found in Lahore and its neighbourhood are a poor lot. All belong to the *Lycæninæ* sub-family, and are, for the most part, only of the very common and inconspicuous species. None of the other sub-families are represented at all, though one might expect to find some of the *Aphnæus* group and perhaps a *Rapala*.

37. *Zizera maha*, Kollar. (721 Bing.; 694 deN.). Fairly common from July to November. Flies low about grass lands.

38. *Zizera lysimon*, Hubner. (722 Bing.; 699 and 700 deN.). Is probably the most common Lycænid in Lahore. Occurs practically throughout the year, except the few very hot weeks of May and June, and is abundant towards the end of and after the monsoon when it swarms about grass and small flowering shrubs.

39. *Zizera gaika*, Trimen. (723 Bing.; 702 deN.). One or two have been taken, but it is by no means common. Occurs in August and September.

40. *Zizera otis*, Fabr. (724 Bing.; 703 deN.). In September and October but never common.

41. *Azanus ubaldus*, Cramer. (725 Bing.; 707 deN.).

42. *Azanus uranus*. Butler. (726 Bing.; 708 deN.).

I have only taken two or three of each of these, and the species appear to be rare. They are, however, inconspicuous insects and many are probably passed over. Usually fly from August to November.

43. *Chilades laius*, Cramer. (728 Bing.; 672 deN.). I have taken an odd specimen or two—in October—but the species appears to be distinctly and unexpectedly rare.

44. *Chilades trochilus*, Freyer. (729 Bing.; 673 deN.). Only once taken, in November. It is, however, such a minute and inconspicuous insect that it is easily overlooked as it flies about grass; and is probably far more common than a single capture would lead one to think.

45. *Tarucus theophrastus*, Fabr. (762 Bing.; 752 deN.).

46. *Tarucus plinius*, Fabr. (764 Bing.; 758 de N.).

Both very common, the former from June to November, the latter from September to November. Fly about *Dodonea* hedges and are very partial to the flowers of the *Plumbago capensis*.

47. *Polyommatus bœticus*, Linn. (772 Bing.; 767 deN.). Appears about the end of October and is common throughout the cold weather.

In addition to the above, *Azanus jesous*, Guerin, (727 Bing.; 709 deN.). *Catochrysops strabo*, Fabr. (759 Bing.; 743 de N.) and *Catochrysops cnejus*, Fabr. (761 Bing.; 745 deN.) have been recorded from the 'Punjab plains'. They will probably be found to occur within our limits. *Catochrysops pandava*, Horsfield, (760 Bing.; 750 deN.), may also turn up, though my experience has been that it is always very rare away from the hills and submontane tracts.

Of the other sub-families, the only species I would expect to occur are *Aphnæus vulcanus*, Fabr. (903 deN.), *Aphnæus ictis*, Hewitson, (914 deN.) or one of its varieties and, possibly, *Rapala melampus*, Cramer, (1006 deN.).

HESPERIDÆ.

The Punjab plains do not suit the 'Skippers.' Only some half a dozen species have been recorded, and individuals of all but two or three of these are rare.

Sub-family—*Hesperinæ*.

48. *Hesperia galba*, Fabr. I have seen and taken only one, in October, but it is probably far more plentiful than a single capture would seem to indicate.

Sub-family—*Pamphilinæ*.

49. *Suastus gremius*, Fabr. Not common, but a few specimens may usually be taken just after the close of the rains.

50. *Padraona dara*, Kollar. Like the last, not very common, but some may always be had between September and early November. I have almost invariably taken it on the flowers of the *Duranta*.

51. *Chapra mathias*, Fabr. Fairly common from the end of the rains till the early part of the cold weather.

52. *Parnara bevani*, Moore. A damaged specimen was taken in November, but I have seen no others though I have kept a look out for them.

53. *Gegenes nostradamus*, Fabr. Was recorded by Longstaffe as "common in the gardens at Lahore" in October-November. I have, however, not seen it.

Sub-family—*Ismeninæ*.

54. *Parata chromus*, Cramer. Irregular, but when appearing, is common for a few weeks in August, September and October. A small leguminous tree, which is found in many Lahore gardens, is a special attraction; one in my garden has always four or five of these insects around it.

Records of distribution would indicate the addition of *Sarangesa dasahara*, Moore, *Udaspes folus*, Cramer, and *Parnara guttatus*, Bremer and Grey, to the above list. Personally, I have considerable doubt whether these species will be found to extend so far into the plains of the north-west.

REVIEW.

A BIRD CALENDAR FOR NORTHERN INDIA

BY

DOUGLAS DEWAR.

(*Thacker Spink & Co.*, 1916, *price* 6 *Shillings*).

Mr. Douglas Dewar is well known as a popular writer on Indian Birds and he has already a number of volumes to his credit; his readers will be glad to welcome this addition to his writings, which is decidedly an improvement on anything that he has hitherto published. Mr. Dewar caters for that portion of the European residents in India who have sufficient interest in birds to learn a little of the nomenclature, habits, and life histories of the more showy and distinctive forms around them, but at the same time are not willing to take their studies very seriously.

As is to be expected from the title the classification of this book is one of the calendar; the book is divided into chapters for the different months and each chapter deals with the chief features of bird life for that month, prefaced with a slight introduction regarding the climate to be expected. These chapters give a very good idea of the salient features of the year's bird life for the United Provinces, but an attempt has been made to attract a larger public by tacking on—often in a somewhat slipshod manner—a number of notes regarding the Punjab. This is a pity: these notes have appeared in another form in our Journal; they destroy the cohesion of the whole, and they fail to make for the Punjabi a convincing picture of the bird life of his own province, except in so far that the extreme southern districts (with perhaps some of the submontain tracts) resemble those of the United Provinces. But this is a common fault in all books that deal with India; the tendency is always to slur over rather than emphasise the divisions of the country, whereas a full appreciation of the divisions and the problems which they suggest add greatly to the zest of Indian studies.

The real value of this book lies in its suggestiveness; as he passes from month to month the reader cannot fail to notice the picture of great and unceasing changes which pass before the mind's eye—changes which are summed up in the word "migration". There are few people in England who do not recognise in some degree the comings and goings of bird life according to the seasons, but it is far otherwise in India. Apart from the Sportsman's interest in the movements of Game and Waterfowl, no heed is paid to the migrations of the birds, although it is on a far vaster scale and more noticeable than in England. A perusal of Mr. Dewar's book should change all this; but while his pages describe clearly the migrations of all best known species, it is to be regretted that he omits to make mention of some of the most interesting forms. To take but a single instance: Blyth's Reed Warbler *Acrocephalus dumetorum* passes through the Punjab in such numbers on the spring and autumn passage that its arrival and departure are most marked and form one of the clearest episodes to the observer interested in migration. Yet no attention is called to it under the appropriate months. This is no accidental omission or error in observation. Mr. Dewar is a most skilled and patient observer as every page of his book bears witness. Yet everywhere he tends to avoid the more obscure points and describe again and again facts and habits which have been well-known to generations of Anglo-Indians. The reason for this is perhaps not far to seek. Mr. Dewar prefers to catch the popular eye in preference to working for the advancement of Ornithology. There are many who regret his choice, for his style is not sufficiently good to make his works attractive for their own sake, while his abilities would make him a most welcome recruit to the ranks of scientific workers, now alas sadly depleted by the war.

To quote Mr. Dewars own word, on page 161 he says: "Very few "observations of the comings and goings of the various raptorial birds "have been recorded; in the present state of our knowledge it is not "possible to compile an accurate table showing the usual order in which "the various species appear. This is a subject to which those persons who "dwell permanently in one place might with advantage direct their "attention."

This remark may with propriety be extended to refer to almost every species, save those which are *known* definitely to be entirely resident. Very little is on record regarding species which are known to be migratory while (as our author says again on p. 72) "the great majority of species, "probably move about in a methodical manner in the course of a year; a "great deal of local migration is overlooked, because the birds that move "away from a locality are replaced by others of their kind that come from "other places."

It is not necessary, however, to add the proviso "who dwell permanently in one place." All observations, however fragmentary, are of value in the present state of our knowledge, provided that they are published and left on record in print for future workers. If all who read this book are encouraged thereby to make a few observations on their own account it will not have been written in vain; let all such make a practice of writing short notes to our Journal after the manner of the numerous class of correspondents who contribute to the "notes and queries" portion of the Naturalist columns of the "Field" newspaper.

In conclusion it may be noted that the volume under review is neatly bound and printed and is remarkably free from errors both of printing and fact. Still in a future edition Mr. Dewar may care to correct his statement that no Owls and Vultures are migratory and to modify some of his theories.

ROLL OF HONOUR.

W. J. NORWOOD RYAN.

I regret exceedingly to inform you that our member Mr. W. J. Norwood Ryan was killed in action in Egypt on September 5th. At the outbreak of the War Mr. Ryan was in a business house in London, but immediately joined an Officer's training corps and finally obtained a Commission in the Dorsetshire Yeomanry; his exceedingly poor eyesight prevented his getting into the Infantry, and would indeed have been a sufficient excuse for the avoidance of Military duties. After a period of training he went to Galipoli and first saw fighting at Sulva Bay; then after short periods at Imbros and Lemnos he rejoined his regiment at Cairo in time to take part in the fight at Agagieh. Some three months later he joined the Camel Corps and was moved to the Senusi front where he was eventually reported "missing" on patrol duty; it is now known that he was killed. Mr. Ryan was a keen Ornithologist and devoted all his holidays to that pursuit. He was a close personal friend of mine and we did a great deal of collecting together. In his letters from the front he never omitted to mention the bird life that he came across.

H. W.

11*th October* 1915.

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MISCELLANEOUS NOTES.

No. I.—MEASUREMENTS OF MARKHOR AND URIAL HEADS.

In case you keep records of heads I think these two which I was lucky enough to get recently may be worth recording:—

		Ground.	*Length.*	*Base.*	*Tip to Tip.*
19-4-1916.	Markhor.	Kajnag.	57″	11¼″	37″
29-12-1916.	Urial.	Kalla Chitta.	34″	10″	18¼″

These are both as good heads as have been shot for some years.

Hassan Abdal, n.w.f.p., A. L. MOLESWORTH, Capt.
14*th January* 1917.

No. II.—JACKALS IN LOWER BURMA.

It is a common belief that there are no jackals in Lower Burma, or at all events in the lower Districts of Lower Burma, so I send you the skin of one that I shot this morning, the 24th November 1916, in the North Myanaung Reserve of the Henzada Forest Division, Kyangin Sub-Division. I shot this animal when walking along an inspection path in the Reserve. He was evidently hunting game for he came running along towards me all the time looking into the jungle to his left.

Twenty-nine years ago when I first came to the Henzada District, there were no jackals and very few hares in the District. Now both are fairly plentiful. About four years ago I caught a jackal cub in the eastern part of the Kyangin Reserve, and again three years ago I got two cubs in the Yenandaung Reserve, which is only forty miles north of Henzada town. I have on several occasions seen jackals in the Kyangin, North Myanaung and Yenandaung Reserves, and have come across their burrows. The jackals in this District seem to have acquired the hunting habits of the wild dog, for I have seen a pack of seven hunting deer not far from where I shot the one this morning, and I have seen kills of barking deer and sambar near Tatkon where I shot the animal this morning, that were undoubtedly those of jackals.

These jackals have either come across the Arakan Yomas, or else they have worked their way down from the Thayetmyo District, possibly the latter.

While on the subject of jackals I may here mention that the three cubs I got, we kept for quite a long time and they got quite tame and used to run loose in the house and were great friends with my dogs. The one I got first, got a nasty sore on his back. He evidently went into the kitchen and the cook threw boiling water on him. The skin came off and a nasty sore formed which attracted flies, and to avoid which the poor beast had to hide about in dark places. One morning he went into the Doctor's compound and hid in the godown under a box. Some servant found the poor beast and told the lady of the house that some terrible animal had got into the godown, so they were ordered to kill it, and so proceeded to go with long poles with which they jabbed at the poor beast. Eventually some one came and told my wife that our jackal had got into the Doctor's godown and that the servants were trying to kill it, so my wife sent men and rescued the poor beast and brought it back to my house. My wife noticed that the jackal could not eat meat, and one day thought that a bone had stuck in its mouth and so opened it to try and get it out. To her horror she found that what she took for a bone from the food was nothing more nor less than the poor beast's jaw bone which had got out of place and was sticking in the mouth, the jaw having been broken by the Doctor's brave body guard. My wife set the bone back and kept the jackal tied up for several days and fed it on rice boiled in soup. In about a fortnight the jaw bone set and the animal was eating bones as usual, it having made a wonderful recovery. Being kept tied up in a dark room away from flies, the back also healed and the animal was as lively as ever. One day some months after, he was found lying dead in the hedge in the garden and we supposed that a snake must have bitten him.

The second two cubs I got, went mad and died. I think they were bitten by a mad dog that came into the compound. One of the cubs bit a valuable Airedale dog I had, and he also died of hydrophobia.

As regards the hares in the District. They have spread right down to the Lemyethna Reserve which is right down in the southern end of the District. I have found them right on the summit of the Arakan Yoma hills at an elevation of 4,300 feet.

The Burmese villagers kill numbers of hares at nights with the help of "Oksoungs" lights carried in a conical shaped basket. One man carries the light on his head and throws the light from side to side, at the same time jingling tiny bells that he has tied to sticks, one of which he carries in each hand. This is to drown the sound of the footsteps. Another man carries a spear or a dah with which he kills the hare. I have seen four and five brought in killed at night. The Burmans also kill deer and pig with the help of these "Oksoungs." In the Delta they also spear alligators in the same way, but here they go in a boat, the light being kept at the prow, and no bells are used. A man stands behind the light with a spear in his hand, whilst another man paddles the boat.

C. W. ALLAN,
Burma Forest Service.

HENZADA,
24th November 1916.

No. III.—KATHIAWAR BLACK BUCK.

When the minor Nawab Saheb of Junagadh was recently camping with Mr. Sladen and ourselves at Una in the south of the State, he secured a fine black buck with horns measuring exactly 25 inches, and giving a spread measurement of 20 inches. I have heard of even better heads being available on this side ; but during the past eleven years in Kathiawar I have personally seen nothing shot with a better length of horn than 24 inches. I think the above head is worth recording as a Kathiawar trophy, though no doubt better records have often been secured elsewhere in India. I may mention that Mr. Sladen and I both together personally measured the length of horns very carefully from root to tip with a tight tape ; and if we had followed the curves of the horns with the tape, the length would have exceeded 25 inches.

It may be worth recording that when we were recently moving camp in the Gir, a forest orderly riding in front of ourselves at 8 a. m. spotted a panther absolutely on the margin of the road in the grass. We had ridden by this spot with our dogs the morning before and luckily we had not them with us on this occasion. The panther when he saw the orderly close to him, quietly decamped ending with a bound into the scrub jungle ; but we were surprised at his bold and confident demeanour.

H. D. RENDALL, I.C.S.,
Administrator, Junagadh State.

CAMP GIR,
6th December 1916.

No. IV.—AN ARBOREAL PANTHER.

In the Miscellaneous Notes of Volumes XVII of the Journal there was some correspondence about panthers putting their kills up trees. Though two members described the habit as " common " or "not uncommon," in the specific instances quoted the animals appear to have been deposited at no great height from the ground and the following account may provide some points of fresh interest. Last hot weather when camping at K. in this district I had goats out for 3 nights before one was killed. This was dragged some 50 yards and left practically intact hanging over the fork of a large pipul tree. The goat had been tied to a log, the exact dimensions of which I forget but it must have been 6 or 7 feet long and weighed perhaps 40 lbs. This had stuck in the fork 11 or 12 feet from the ground and the goat hung suspended on the other side. I sat up in a well concealed machan till dark, but though the place was quiet and it was unlikely the panther had been lying up within hearing, it did not return. Next morning I had to move camp.

At X'mas I was again at K. and had goats out in the same bit of jungle as well as in an isolated bit of rather light jungle a mile away and on the far side of the village, open fields and a broad tank. Here a panther made his X'mas dinner off one of them. It had been tied to a small bush and the panther must have tugged persistently to remove it, for neither rope nor bush had given away and the knob had finally slipped over the top, baring it of leaves and twigs. Thirty yards away lay a lot of the goat's hair but the goat itself was nowhere to be found. Finally we came to the conclusion that the panther must have finished it "with the bones and the beak" in honour of the day, and, it was decided to sit over a fresh live goat. We looked up to select a tree and there high above us was the goat! It was in the fork of a 'mutti' tree 23 feet from the ground by measurement. The tree was quite a slender one, 2 feet 9 inches in circumference at the foot and with only two branches below that over which the goat hung and one of these close below it.

Though but little of the goat was eaten and as before there was little likelihood of the panther having heard the machan being built, yet it failed to return before dark and I had not the hardihood to wait below in the hopes of an overhead shot against the stars.

Next morning the remains of the goat were found in a banyan tree about 100 yards away. Only the head and part of the skin were left and these deposited 12 or 14 feet from the ground. I sat up again that evening but with no better luck than before.

It is interesting to speculate what induced this habit—presuming the same panther to have been concerned in each case. A natural suggestion was that it was done to secure its meal from red dogs which are plentiful in the jungle in which the first kill occurred, but its actions must have been guided by instinct rather than reason, for in that case though the branch over which the goat hung was not less than 11 feet up, the goat itself suspended at the end of the rope stretched down to within easy reach of any dog.

Possibly a further acquaintance with the same animal will throw more light on the question. The habit of only returning late to its kill may also be one of its characteristics.

DHARWAR, *8th January* 1917. J. R. JACOB, I.P.

No. V.—NOTE ON THE SCALY ANTEATER (*MANIS CRASSICAUDATA*).

About 3 p.m. on the 11th February 1914, in the North Toungoo Division, I noticed close to my tent what I thought was a snake coiled round the top of a small tree about 12 feet from the ground. It was a large pangolin and was so tightly coiled round the tree that a man who climbed the tree could not dislodge it and it was only freed from the tree after the tree had been cut down. When it rolled itself into a ball it placed the toes of its hind feet under the scales of its chest and it was very difficult to straighten it out. It was infested with ticks of the kind one commonly finds on snakes (*Apomma* ?). I enclose a photograph* which shows the strength of the prehensile tail, the whole weight of the body being supported on the branch from which it hangs by the extreme tip of the tail (the pangolin and the binturong *Felis binturong* both found in Burma are the only mammals of the old world with a prehensile tail.) In the evening I let it go in the jungle to the great disgust of the Burmans who said they could get Rs. 15 for it from any Chinaman. Chinamen use parts of these animals as an aphrodisiac. Burmans have a widespread superstition about this animal that it cries out and calls people by name. If the person called replies he dies at once. I was told by a fairly well educated Burman that a Forest Ranger who died suddenly at Pyinmana Forest School sometime ago died because he replied to a scaly pangolin. This superstition is a nuisance as Burmans are very reluctant to reply to shouts in the jungle. I have often noticed this when girdling teak or when belated dak runners are approaching camp after dark. It would be interesting to know whether this animal does cry out and whether its cry at all resembles the human voice?

S. F. HOPWOOD, I.F.S., R.F.A.

FRANCE,
31*st August* 1916.

No. VI.—LARGE PINTAILED SANDGROUSE (*P. A. CAUDATA*) SETTLING ON WATER.

I have occasionally wondered whether my eyes were deceiving me when I thought I saw Sandgrouse settling on the water to drink. But I have now been able to verity this habit, in one species at any rate. A day or two ago a pair of *Pteroclurus alchata caudata* settled in front of me, on the R. Tigris, and about 60 yards from the bank. After slaking their thirst in a leisurely manner, they got up, and flew away. When on the water they floated high, and looked like gulls. I do not know whether this habit has been recorded before in the case of Sandgrouse, or not, but mention it for what it is worth.

H. A. F. MAGRATH, LT.-COL.

MESOPOTAMIA,
12*th November* 1916.

No. VII.—OCCURRENCE OF THE WOOD-SNIPE (*GALLINAGO NEMORICOLA*) IN SALSETTE.

On January 18th I shot a Wood-snipe in the jungle, a few miles from Thana. The locality agreed with that described by Stuart Baker as being the one most favoured by this species (*vide* article on the Wood-snipe beginning on page 270 of Vol. XX of the Journal), that is to say the bird was flushed out of thick high grass bordering a long series of small rice fields in a narrow valley in the midst of thick jungle at a height of perhaps 100 feet above sea level. The time of day was 11 A.M. The snipe got up without any cry and flew straight for a narrow gap in the high grass where he meant to adopt Wood-cock tactics. He flew slowly and floppily and looked strangely big and most strangely dark. I had to take him before he dodged behind cover and consequently he was rather broken up. The bird was in good condition and was made over the same evening to the Society and his measurements recorded. Having shot a couple of this species in Kulu I was pretty sure of its identity but not knowing it to be so unusual did not question the shikari as to the frequency of its occurrence. He appeared to know of it quite well, but his knowledge may have been assumed. Only one specimen is recorded as having been shot near Bombay before, that of Mr. T. H. Moore in January 1896. Possibly the species occurs not uncommonly, but is not identified.

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* Unfortunately the photograph is too indistinct for reproduction.—EDS.

The Wood-snipe weighed 5½ oz.

M. L. FERRAR, MAJOR.

BOMBAY, 31*st January* 1917.

No. VIII.—NOTE ON THE HABITS OF THE CHECKERED WATER SNAKE (*TROPIDONOTUS PISCATOR.*)

A few days ago I saw an interesting display of fishing by a snake. The basin in front of the sluices of Walwhar lake was being emptied through the 15th valve provided for that purpose and numbers of small fish were being shot through and as they came out of the pipe were trying to jump clear of the stream of water. The snake was sitting on top of the pipe and darted its head at the fish in the air. I saw it catch one fish about 4″ long but it only managed to hold it for a few seconds before it broke away. I killed and preserved the snake and am sending it down to you and should be much obliged if you would kindly identify it.

B. D. RICHARDS.

LONAVLA,
2*nd December* 1916.

No. IX.—FEEDING HABITS OF THE PYTHON (*PYTHON MOLURUS.*)

I enclose a photo of a 13½ feet Python which I killed sometime ago in the Northern Shan States about 15 miles from Lashio. The reptile had

only lately swallowed a 3 year old barking deer (male) which, when the snake was opened up, was found quite fresh inside, some of the hair being still dry. The only bone broken was the near hind leg ; the fore legs and ribs were intact. The horns were gone too ; at least I take it there had been horns for the roots were raw and bloody. I may add that a couple of Burmans asked for permission to take the deer away to eat! Permission was granted. My cook a Burman, rather amused me by stating quite gravely that the snake, after digesting its meal, would hang itself by the tail over the branch of a tree and shake its head until the indigestible bones came up. It would be interesting to know if a like superstition exists in Assam or in other places where this variety of snake is found.

I may add that the measurement was taken by tape as the reptile lay on the ground and was found to be just over the 13½ feet.

C. G. STEWART.

MINBU, BURMA,
7th October 1916.

No. X.—OCCURRENCE OF RUSSELL'S EARTH SNAKE (*ERYX CONICUS*) AT 2,200 FEET ALTITUDE IN THE C. P.

Herewith the Railway receipt for the Earth Snake *Eryx conicus* despatched to-day. As he was caught on the 2nd instant and has not fed since, he should be redeemed quickly.

I was waiting for the beat to come up, in scrub jungle, when a grasshopper flying away with signs of agitation attracted my notice to the snake. The aboriginals, after inspection, pronounced it to be highly venomous! " He blows on men and cattle and they swell as large as elephants. He kills his prey like the python." This was half true.

On consulting the map of its distribution in your Journals I notice that its occurrence in the C. P., at a height of about 2,200 ft., is remarkable.

C. G. CHEVENIX TRENCH, I.C.S.

BETUL, C. P.,
7th December 1916.

No. XI.—NOTE ON THE HAMADRAYAD OR KING COBRA (*NAIA BUNGARUS*) IN NORTH KANARA.

The Hamadrayad is nowhere very common, and many years ago, when engaged on survey work in North Kanara, I never even heard of one although I had the best of opportunities for doing so. The first one that I ever saw in the district, was at Supa, in 1914 when revisiting my old haunts. It was found coiled up in the fork of a tree near the Kali Nadi, by wood cutters, who informed some snake charmers living at Supa, of their find and the latter went out at once and snared it. It was a fine adult specimen about 11 feet long and of a pale olive-green colour, but did not look very happy when I saw it, owing to the bad treatment it had received at the hands of the snake charmers, who had extracted its fangs.

This year (1916) when encamped at Potoli in the same district, I was fortunate enough to be able to renew my acquaintance with the snake. I had for sometime been offering a reward to any one who would show me one, but although the natives were apparently well acquainted with the snake and had a wholesome dread of it, they said that it was very rare.

However, one day, one of the local *Gowdas*, or village headmen, came and announced that he had learnt, of the whereabouts of a *Nagin*—the local name for the Hamdrayad—from a man who, when coming along a short cut, as a guest to some marriage festivities at the Gowda's house, saw it lying on the top of a heap of dead leaves by the side of the path.

The *Gowda* added, that he would find out from this man, the exact spot where the snake had been seen and take me to it, as soon his marriage festivities were over, promising me that we should find it still there. The path, he added, had in the meantime been closed, as no one dared to use it.

Some days later, the *Gowda* returned to say that he had just come from seeing the snake which was lying on the heap of leaves just as when it had first been seen. It did not take us more than a few minutes to reach the spot. The mound of leaves, which was about 2 feet high with a circumference of about 8 or 9 feet, stood in the *rai* or evergreen jungle at the bottom of a decline in a small dry *nala*, about 30 yards below the road leading up the Potoli Ghat, and within a few feet of the footpath already mentioned.

I had no means of catching the snake alive, so had taken my gun with me. The light in the *rai* was none of the best, at the time, but after a little manœuvring, I managed to catch light of what appeared to be the snake's head, and fired. There was much struggling amongst the leaves when I did so, but a second shot into the heap put a stop to this.

On hauling the snake out of the leaves I was disappointed to find that it was a comparatively small one being only 9′-3″ in length, and judging from its colour which was jet black with irregular yellow bands about ½ inch wide, at 3″ intervals all down its body and tail, it was apparently a young one. The throat was yellow and it had all the necessary scales, to prove it was a Hamadrayad.

On seeing it at close quarters, the *Gowda*, and in fact all the natives said that this was the *Kali* or *Derad Nagin*, and known as such by its dark colouring. The other, light coloured one, they called *the Nagin*, not being aware that in reality, they were one and the same snake, at different stages of its growth, although according to Wall, the adults vary a good deal in colour and are sometimes coloured like the one I shot.

I have never seen noticed anywhere the habit these snakes appear to have of lying up in heaps of dead leaves which are undoubtedly collected together for the purpose. The *Gowda* who seemed to be well acquainted with the habits of the snake said that they invariably make their home in such a heap.

I examined the heap of leaves carefully but found nothing in it, nor did I succeed in finding another snake.

On dissection I found the stomach quite empty. Its body was covered with a large number of tics, holding on below the scales.

L. L. FENTON, Lt.-Col.

Marsh Hall, South Molton, N. Devon,
22*nd October* 1916.

XII.—FOOD OF THE BULL FROG (*RANA TIGRINA*.)

I am sending you two frogs and I hope they reach you alive. I was in my room dressing for dinner when I heard a noise similar to that made by a frog when caught by a snake. I called my servant and told him to take a lamp and kill the snake. He and two other Kalasis went to do this—the boy then returned and told me that it was not a snake but another frog biting a frog and eating it. I went out and there I saw the green frog that has the thin white streak from nose to rump firmly attached to the back of the ordinary frog and when touched would not leave or let loose his grip. The green frog had the skin of the other frog in its mouth and when teased he jumped quite 2½ feet with the other frog in its mouth.

N. DAVIDSON.

RAICHUR,
19*th October* 1916.

[The 'two frogs' when received were found to be a medium sized Bull Frog (*Rana tigrina*) and a young common Toad (*Bufo melanostictus*) which was evidently being eaten by the former.—EDS.]

No. XIII.—THE GREAT INDIAN SPIDERS, (GENUS *PŒCILOTHERIA*).

In a very interesting account of the Great Indian Spiders, by R. I. Pocock of the British Museum of Natural History, which appeared in the Annals and Magazine of Natural History, Series 7, Vol. II in January 1899, and was reprinted in Vol. XIII, No. I of our Journal, it was stated that eight different species of the spider were then known to the Museum, which also possessed specimens of one or both sexes of each species.

These were:—

No. 1, *P. fasciata*, from Ceylon.
" 2, *P. subfusca*, " Ceylon.
" 3, *P. vittata*, " India.
" 4, *P. regalis*, " "
" 5, *P. formosa* " "
" 6, *P. metallica* " "
" 7, *P. striata* " "
" 8, *P. ornata*, " Ceylon.

The males of 1·2 and 4 only were known, so there was much room for further research, but I am not aware that any further discoveries have since been made.

These spiders are not, I believe, as rare as is generally supposed, but living as they do, in burrows and trees, they escape observation.

Last April, one was brought to me at Khandala, it having been found in a hole half way up a post in the stables at the Convalescent Home. Not a single person there, either European or Native, to whom I showed it, had ever seen one before. I have since had no difficulty in identifying it as *P. regalis*; Pocock mentions having identified this species from Matheran, so it may be the commonest, if not the only species found in this part of India. I tried my best to get another specimen but with no success.

In May last, I was more successful, when encamped at Potoli, Supa Taluka, North Kanara, where I captured two females, but they belonged to quite a different species which I have not as yet been able to identify. Their description tallies more nearly with that of *P. metallica*, than with any of the others on Pocock's list, being of a uniform chocolate colour all over the body and legs, but wanting the single orange spots on the *tibiæ*, which is the distinguishing mark of *P. metallica*. At the first opportunity I intend to have them identified at the Natural History Museum, when I will communicate the result.

The measurements of the largest of the two are as follows, in *millimetres*:—

Total length of body	55
Length of carapace	26
Width of carapace	20

Length of palp	47
,, ,, 1st leg	74
,, ,, 2nd leg	66
,, ,, 3rd leg	55
,, ,, 4th leg	70
Patella and Tibia of 1st leg	28
,, ,, ,, 2nd leg	25
,, ,, ,, 3rd leg	20
,, ,, ,, 4th leg	25
Protarsus of 4th leg	16

Quite by accident, I came across a silk lined burrow, in the jungles, which I suspected belonged to one of these spiders. On introducing a stick into it, I however failed to move or feel anything, so placing a dead leaf over the mouth of the burrow, I left it until the following morning, when on my return I found that the leaf had been moved aside during the night and fastened with a few threads to one side of the mouth of the burrow—clear proof that the latter was occupied. The burrow was made on a clean open space of slightly sloping ground, away from any trees or shrubs. The ground was very hard, and it was not until I had dug to the very bottom of the burrow—2 feet in an almost perpendicular direction,—that I found the spider, and about 30 or 40 young ones crawling over and around her. The mother showed very little fight. The young ones measured about 1/3rd inch across. The diameter of the section of the burrow measured as nearly as possible 2 inches. The burrow was beautifully lined with silk throughout.

On looking about, I found another burrow, within a few yards of the first one. It was a *facsimile* of the latter and like it contained a female with a large number of young ones of a similar size as the first lot.

Unlike the natives I enquired of at Khandala, those in Kanara were perfectly well acquainted with these spiders which they knew by the name of " Waghzin's."

They stated that their bite would draw blood and that they were poisonous but the poison was not of a very virulent nature ? Pocock mentions that they possess poison-glands of large size, and are armed with irritating bristles.

L. L. FENTON, Lt.-Col.

Marsh Hall, South Molton, N. Devon.
22nd October 1916.

No. XIV.—THE "PREYING MANTIS" AS AN ENTOMOLOGIST.

My knowledge of the *Mantidæ* is very limited, but I had always understood that they preyed on comparatively small insects, such as most of us have seen them *shikaring* on our dinner tables. I was mistaken, but I must say I was considerably surprised to find one tackling one of the *ornithoptera* group of butterflies.

Last May, I was encamped at Potoli in the Supa Taluka, North Kanara, and one morning, when hunting butterflies in the local evergreen jungle, noticed a *Papilio minos* ineffectually struggling to get away from a large bunch of flowers, on a tree, about 12 feet above the ground. I at once thought it must have got entangled in a spider's web, but there was no time to waste, and hastily scrambling up the tree, with the assistance of a native, I succeeded in clapping my net over the flower before the butterfly had escaped, and broke the former off at the stem. On regaining the ground and carefully examining my capture, I found no trace of a spiders' web nor was there anything of a sticky nature on the flowers, whereas, besides the latter and the butterfly, the net contained nothing else but a large "Preying Mantis" about 4 inches long and I am quite convinced that it alone was responsible for the capture.

I only regret I omitted to preserve the Mantis in order to ascertain its species.

L. L. FENTON, Lt.-Col.

Marsh Hall, South Molton, N. Devon,
22nd October 1916.

No. XV.—SOME CERAMBYCIDS FROM KURSEONG.

A miscellaneous collection of insects made by me in the Government Forest at Kurseong (altitude 6,000′ and over) include the following Cerambycids. The numbers against each species refers to the same in the *Fauna of British India* Series, Coleoptera Vol. 1, *Cerambycidæ* by Gahan :—

Sub-family, Prioninae.

5. *Lophosternus indicus*, Hope.
41. *Ægosoma tibiale*, White.

Sub-family, Disteniinae.

54. *Cyrtonops punctipennis*, White.
57. *Distenia kalidasæ*, Lameere.

Sub-family, Cerambycinae.

131. *Hoplocerambyx spinicornis*, Newman.
133. *Pachydissus parvicollis*, Gahan.
194. *Rosalia hariola*, Thoms.
197. *Rosalia formosa*, Saund.
205. *Zonopterus flavitarsis*, Hope.
220. *Chloridolum nympha*, White.
263. *Xylotrechus subdepressur*, Chevr.
374. *Aglaophis fasciata*, Thoms.

E. A. D'ABREU, f.z.s.

Central Museum, Nagpur,
3rd October 1916.

No. XVI.—NOTE ON A FLIGHT OF *SPHINGIDÆ*.

On the 18th October at about 5 a.m., some 60 miles off the North-Western Konkan Coast, (Lat. 19. 45 N. Long. 71. 40 E.) I was fortunate enough to observe a remarkable flight of *Lepidoptera*.

The vast bulk of these belonged to the *Sphingidæ* of which I took the following species :—

Acherontia lachesis ..	Only one specimen.
Protoparce convolvuli ..	Six specimens.
Nephele hespera ..	Eleven specimens.
Choerocampa theylia ..	Many hundreds.
Choerocampa celerio ..	About one hundred seen.

Amongst the above at least one or two species of *Choerocampa* which I have not as yet identified.

In addition there were many *Noctuidæ*, *Geometridæ*, *Bombycidæ*, and a sprinkling of butterflies amongst which latter I observed *Teracolus vestalis*, *Terias* and a few *Hesperidæ*. Two species of *Odonata* and one *Phasmid* were also observed. The insects had apparently been carried seaward in the recent cyclone as we were in its neighbourhood at the time. The moths came at dawn and for some hours afterward they could be seen clinging to every kind of object, coils of rope and cane chairs being the favoured resting spots, these harmonising with their colouration and affording some protective concealment. The *Convolvuli* in particular chose coils of seasoned rope and weatherworn wood on which it was quite difficult to spot them.

I saw more *Sphingidæ* in one hour than I had seen in a decade in India.

F. C. FRASER, CAPT., I.M.S.,
Hospital Ship "MADRAS."

BOMBAY, 20*th Sept.* 1916.

No. XVII.—NOTES ON THE LARVA OF *DILEPHILA LIVORNICA* (STRIPED HAWK MOTH).

I found large numbers of lavæ feeding on a milky plant with a yellow flower at Changla Gali, Murree Hills, in June.

The plant was growing in a single sunny nullah and spur, and there must have been many hundreds of lavæ in this small area.

When first hatched the larva is a dirty white colour, with the head and horn black. When about half an inch long a number of white dots appear. These dots gradually form into a series of eleven white spots on each side, the head and horn being black, and the rest of the body black, dotted with white.

When the larva is about one and a half inches long, all the white markings turn yellow, only the spiracles being white. As the larva grows the yellow spots become more conspicuous.

When full grown it is over three inches long, and has a very striking appearance.

After reaching full growth the larva becomes very restless, leaves the good plant and searches for a suitable place in which to pupate. It digs a few inches into the ground, spins a slight coccoon and turns to a pupa in about a week. The pupa is a bright reddish brown colour, with darker markings, the head and thorax being green with brown dots.

Moths emerged in March 1916 from pupæ obtained in June 1915.

In spite of its conspicuous colouring, the caterpillar feeds during the day, often a large number of all sizes on one plant, with no attempt at concealment. When the plant is approached, all the caterpillars jerk back the head and upper part of the body, and eject from the mouth large drops of a clear green fluid. The drops fall in a small shower round the plant. From these habits it would appear that the caterpillar is distasteful to insectivorous birds, etc. I noticed some caterpillars which I kept, sucking up greedily the milky juice which exuded when the food plant was broken.

South in describing the larva of the Striped Hawk Moth (*Dilephila livornica*) in his "Moths of the British Isles" does not mention this habit, so like that of some grasshoppers, of ejecting fluid from the mouth.

I do not know of any other Hawk Moth larva which has this habit.

F. B. SCOTT, CAPT., I.A.,
Atthd. 69th Punjabis.

PROCEEDINGS

OF THE MEETING HELD ON THE 17TH JANUARY 1917.

An "At Home" of Members and their friends of the Bombay Natural History Society took place on Wednesday, the 17th January.

The election of the following 34 new members since the last meeting was announced:—The Principal, Mayo College, Ajmer; H. R. H. Prince Abhakara of Chumporu, Bangkok, Siam; 2nd-Lt. G. R. Smith, I.A.R.O., Mesopotamia; Lt. W. R. F. Trevelyan, Mesopotamia; the Mess President, 2-8th Gurkha Rifles, Landsdowne; Lt.-Col. R. A. Firth, Landsdowne; Lt. T. R. Livesay, I.A R.O., Mesopotamia; Mr. O. Haefliger, Lyallpore; Mr. A. N. Grieve, Purulia; Mr. Duncan Macgregor, Lahore; Capt. C. H. B. Borth, R.A.M.C., Basra; Mr. C. E. Lynch-Blosse, Junagadh; Mr. A. MacDonald, Champaran; Rev. A. F. R. Bird, Nandyal R.S.; Lt. N. M. Adam, R.A., Mesopotamia; Lt. D. P. Blair, R.A M.C., Bushire; Prof. I. W. Johory, M.A., B.D., Indore; 2nd-Lt. R. E. Cheesman, Basra; Mr. G. Wesche Dart, Bombay; Mr. S. G. de C. Ireland, I.C.S., Fatehpur; Capt. G. H. Russell, Wano; the Secretary, Central Circulating Library, S. I. Railway, Trichinopoly; Lt.-Col. C. D. Dawes, I.M.S., Bombay; Capt. J. Crompton, Bannu, N.W.F.P.; Mr. H. Parker, I.C.S., Homalin; Mr. A. C. Morrell, Travancore; Lt. Ernest E. Cunnah, R.A.M.C., Meerut, U.P.; Mr. R H. Cassell, Moniarah; Mr. George D. Moore, Moniarah; the Mess President, 94th Russell's Infantry, Tank, N.W.F.P.; Mr. G. D. Traylen, Bombay; Mr. W. K. Dods Calcutta; Mr. W. E. Ley, I.C.S., Chanda, C.P.; Mr. A. Hampson, Bombay.

The contributions to the Society's Museum during the last four months are remarkable for the wide range of localities from which they have been received—localities extending from Mesopotamia to Siam and from Gilgit to Trichinopoly.

Beginning with Mesopotamia the Society is much indebted to Sir Percy Cox and Lt. R. E. Cheesman, I.A.R.O., for 37 bird skins, all of which are of great interest. From Major-General Sir H. Keary come several spotted sandgrouse and two starlings very similar to the European Starling. Capt. C. R. S. Pitman has sent in skins of two kinds of sandgrouse and two birds of prey, an eagle and a buzzard, and Major F. P. Connor a number of insects, snakes, lizards and birds and a scorpion alive. Lt.-Col F. Wall, C.M.G., I.M.S., and Lt. Livesay, I.A.R.O., have presented much wanted jackal skins and the latter has also sent the head and neck of a wild goose *A. ferus.* From Major G. A. Perreau a fine wild cat also several bird skins. From Capt. C. M. Ingoldby, R.A.M.C., comes a Persian robin, while Col. Stevens and Major Dickinson took the trouble to send down alive two small desert lizards of the genus *Agama.* Lower down the Gulf, at Muscat, Major A. R. Burton has been active in increasing the Society's collections and he has sent in the skin of an Arabian fox, numerous lizards and snakes, as well as a number of birds alive, including some Arabian seesee and Close-barred Sandgrouse. On the other side of the Gulf, in Persian Baluchistan, Capt. J. E. B. Hotson, I.A.R.O., has done much on the Society's behalf and two small but interesting collections of mammals, birds, snakes and insects, as well as botanical specimens have been received from him.

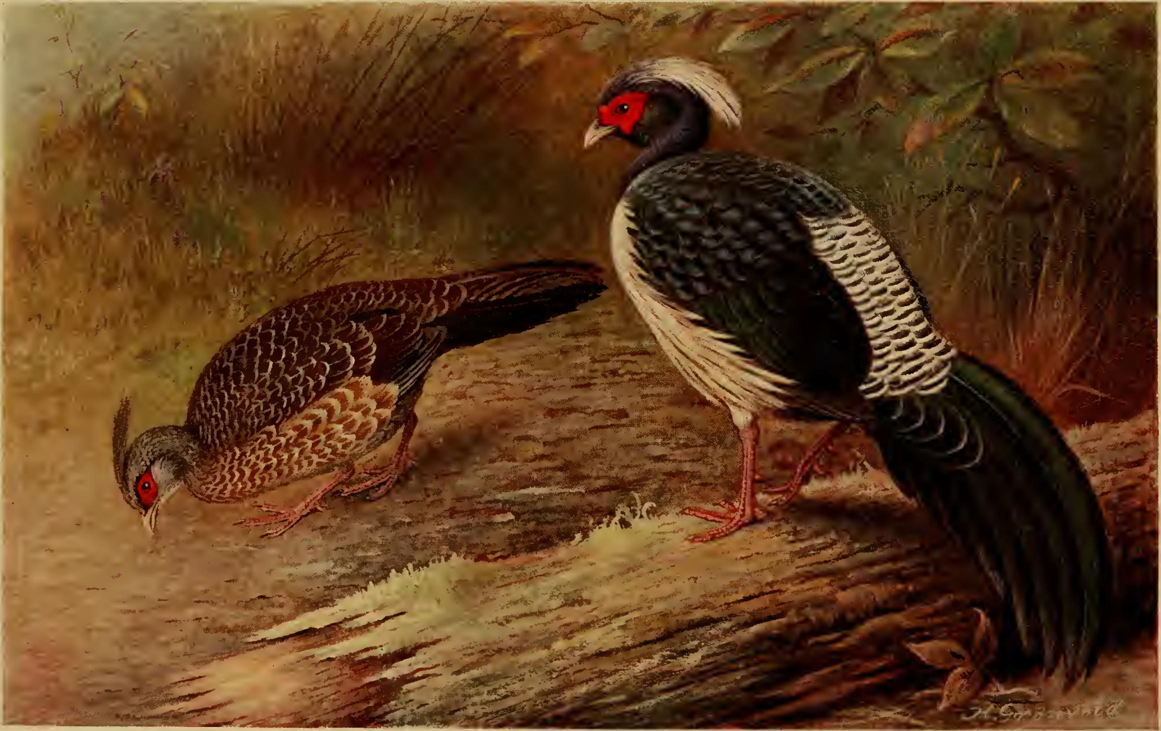
Coming now to the borders of India proper, Capt. W. B. Cotton, I.A.R.O., from Wano, has presented two fox skins, a couple of Afghan hares, also a skin of a cat which appears to be a hybrid between a domestic and a desert cat *F. ornata.* Major Humphrys from Miranshah sent in a live fat-tailed lizard perfectly harmless, but often considered by natives to be a poisonous species. From Gilgit Major A. D. Macpherson has presented a Levantine viper, a European species only occasionally found in India. A number of interesting bats from the Teesta Valley have been received from Mr. A. Primrose and Mr. F. Field. Palamau has contributed several snakes and mammals and from Dr. Malcolm Smith in Siam has come a welcome collection of snakes, lizards and frogs. A number of Imperial Sandgrouse skins have been presented by Col. H. H. the Maharaja of Bikanir and from Simla Mr. G. C. Shortridge, who was there on sick leave from Mesopotamia, sent some butterflies. Mr. T. R. Bell has generously handed over to the Society a collection of shells made at Karachi as well as a large number of butterflies, moths and other insects, comprising some 1,900 specimens all perfect specimens from Kanara. It is hoped to be able to furnish a detailed list of this collection shortly.

The Honorary Secretary acknowledged the following contributions since the last meeting :—

Contribution.	Locality.	Donor.
Three mammals : Tibet Marmot, *A. himalayanus*, Pale Weasel, *M. temon*, Large-eared Mousehare, *O. aurita*.	Garhwal	Mr. A. E. Osmaston, I.F.S.
1 Common Wolf, *C. pallipes* ..	Etawah, W. P. ..	U. P. Govt.
1 Andaman Palm-civet, *P. tytleri*.	Port Blair ..	Mr. F. B. Leach, I.C.S.
1 Jackal, *C. aureus* and head and neck of Grey Lag Goose, *A. ferus*.	Mesopotamia ..	Lt. I. R. Livesey, I.A.R.O.
5 Mammals : 2 Desert Foxes, *V. leucopus*, 1 hybrid ? Desert cat, *F. ornata*, 2 Afghan hares, *L. tibetanus*.	Wano ..	Capt. W. B. Cotton.
1 Jackal, *C. aureus*	Mesopotamia ..	Lt.-Col. F. Wall, I.M.S., C. M. G.
6 Mammals, including, Panther, *F. pardus*, Afghan Hedgehog, *E. megalotis*, Persian Lowland Hare, *L. craspidotes*, 2 mice, a bat and a fox, 33 birds, 4 fishes, 33 snakes, 2 lizards, 3 scorpions, 2 centipedes and a number of insects and botanical specimens.	Pers.-Baluchistan Frontier.	Capt. J. E. B. Hotson.
1 Fishing Cat, *F. viverrina* ..	Habb river ..	Mr. R. L. McCulloch.
1 Jackal, *C. indicus*	Henzada, Burma.	Mr. C. W. Allen.
1 " "	Taungdwingye, Burma.	Mr. F. C. Purkis.
1 Bamboo Rat, *C. badius* ..	Chin Hills ..	Mr. A. Wright.

Contribution.	Locality.	Donor.
1 Arabian Fox, *V. arabica*, 2 snakes, *T. guntheri*, *Z. rhodorachis*, 2 lizards, 1 centipede, 6 scorpions and some insects, also 5 Close-barred Sandgrouse, *P. lichtensteini*, Arabian Seesee, *A. heyi*, Barbary Falcon, *F. barbarus*? 4 Persian Turtle Doves, *S. t. arenicola* and 1 Blue Roch Thrush, *M. saxatiles.*	Muscat	Major A. R. Burton.
Four mammals, including a Persian Mungoose, *M. persicus*, and a Syrian Hedgehog, *E. calligoni*, and 3 birds, 1 Blue cheeked Bee-eater, *M. persicus* and Pin-tailed Sand grouse, *P. a. caudata*. 3 Lizards .. .. .. 1 Tree Frog and a number of insects.	Mesopotamia ..	Major F. P. Connor, I.M.S.
Five Mammals: 1 Short-tailed Mole, *T. micrura* and four bats.	Gopaldhara ...	Mr. H. Stevens.
3 Mammals: 1 Smaller Bandicoot Rat, *B. nemorivaga*, 1 Fulvous Leafnosed Bat, *H. fulvus* and 1 pipistrelle, 1 bird. 5 Snakes: Brown Tree Snake, *D. trigonata*, Painted Tree Snake, *D. pictus*, Green Pit Viper, *L. gramineus*, Kukri Snake *O. subgriseus* and Green Whip snake, *D. mycterizans.*	Niterhat Dist., Palamau.	Mr. F. Field.
1 Scorpion		
18 Bats	Teesta Valley ..	Mr. A. Primrose.
1 Jungle Cat, *F. chaus*; Three birds: 1 Montagu's Harrier, *C. cineraceus*, 2 Spotted Sandgrouse, *P. senegallus* and 1 Black Partridge, *F. vulgaris*	Mesopotamia ..	Major G. A. Perreau.
1 Snake, *Coluber hodgsoni*, alive. 1 Spotted Himalayan Scops Owl, *S. spilocephalus.*	Dharamsala ..	Mr. C. H. Donald.
5 Snakes: Royal Snake, *Z. diadema*, Iridescent Earth Snake, *X. unicolor*, Buff-striped Keel-back, *T. stolatus*, Banded Krait, *B. fasciatus* and *S. olivaceus.* 2 Scorpions	Pegu, Burma ..	Mr. J. M. D. Mackenzie.

Contribution.	Locality.	Donor.
1 Krait, *B. cœruleus*	Deolali	Capt. Malone.
10 Snakes .. .. .. 14 Lizards .. .. .. 10 Frogs	Siam	Dr. Malcolm Smith.
1 Snake, *Dipsadomorphus hexagonatus* (alive).	Monachera P.O. ..	Mr. W. Short.
1 Levantine Viper, *V. libetina* ..	Gilgit	Major A. D. Macpherson.
7 Birds : 5 Spotted Sandgrouse, *P. senegallus*, 2 Starlings, *S. vulgaris*.	Mesopotamia ..	Maj-Gen. Sir H. Keary.
11 Bird skins : Spotted Sandgrouse, *P. senegallus*, Pintailed Sandgrouse, *P. a. caudata*, Long-legged Buzzard, *B. ferox*, Steppe Eagle, *A. nepalensis*, Crested Lark, *G. c. magna*, Skylark, *A. arvensis*.	Do. ..	Capt. C. R. Pitman.
36 Bird skins and 3 beetles ..	Do. ..	Sir P. Z. Cox and Lt. Cheesman.
1 Rufous Cylinder Snake, *C. rufus*	Bhamo	Capt. A. C. Frere.
1 Spotted Sandgrouse, *P. senegallus*.	Mesopotamia ..	
1 Bittern, *B. stellaris*	Bombay Dist. ..	Mr. A. F. Forbes.
2 Lizards, *Agama isolepis* (alive) ..	Busra	Col. Stevens and Major Dickinson.
25 Imperial Sandgrouse, *P. arenarius*.	Bikanir	H. H. the Maharaja.
2 Coronetted Sandgrouse, *P. coronatus*.	Kohistan ..	Mr. R. L. McCulloch.
1 Water Cock, *G. cinerea* ..	Marmugao ..	Mr. W. Coen.
1 Persian Robin, *E. hyrcanus* ..	Mesopotamia ..	Capt. C. M. Ingoldby, R.A.M.C.
1 Fat-tailed Lizard, *E. macularia* and a buprestid beetle.	Tochi Valley ..	Major F. H. Humphrys.
A number of snakes, fish and centipedes in spirit, a large number of butterflies, moths, dragonflies, grasshoppers, mantids, cicadas, hemiptera, diptera and spiders, a quantity of shells and four eggs of common peafowl, *P. cristatus* and four of common sandgrouse, *P. exustus*.	Kanara and Karachi.	Mr. T. R. Bell.
A few birds, fish, lizards and insects.	Karwar	Mr. N. B. Kinnear.



Gennæus albocristatus.

The White-crested Kalij.

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JOURNAL

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THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U.

PART XXII.

With a Coloured Plate.

PHASIANIDÆ.

Genus—*GENNÆUS*.

In 1915 I wrote a revision of this beautiful group of pheasants, which appeared in the Journal of this Society, Vol. XXIII, p. 658 (May 1915). I then gave at considerable length my reasons for retaining some of the species and sub-species which had been described by Oates and others, and for eliminating a large number which, with the greater material then available, were found to be untenable.

Since this review was published, there are only two points upon which I have been able to obtain further evidence and material to show that the deductions then drawn require alteration.

The first of these necessitates the suppression of *cuvieri*. There appears to be no doubt that this so-called sub-species has no definite geographical range, but crops up here and there where the lower habitat of *horsfieldi* meets suddenly the higher habitat of *nycthemerus rufipes*, *williamsi*, or *oatesi*. The skins which I have been able to examine show that *cuvieri* is either a hybrid between totally distinct species, or merely forms a very thin, ill-defined line of connection between *horsfieldi* and various other sub-species. Nowhere is this line sufficiently defined or wide enough to justify *cuvieri* being retained as a good sub-species.

Secondly, the discoveries of Robinson, Guildenstolpe, Herbert, Kloss, and others have shewn that the range of true *lineatus* has to be very greatly extended, though still further material is required before we can say definitely what is the range of *lineatus* and what of *sharpei*. It would appear, however, that Silver Pheasants of some kind very nearly related to, if not the same as, *Gennæus lineatus lineatus*, are to be found as far South as 12°, and also East well into many portions of South and West Siam. At what particular point *lineatus* merges into *sharpei* has still to be worked out with exactness, and to do this will require a much greater mass of material than is now available.

I retain *ripponi* for the present, though with a good deal of hesitation, and if more specimens for examination are obtained from the Trans Salween and Mekong River areas this sub-species may also have to be suppressed.

The Genus *Gennæus* contains the pheasants popularly known as Kalij and Silver Pheasants, and are certainly the most closely allied of all our Indian Pheasants to the Jungle-Fowl. They are heavily built, powerful birds with comparatively short rounded wings; tails compressed, of sixteen feathers, either of great or moderate length, and with the central feathers longest; their legs are short and fairly long, and are armed in the males with powerful spurs, one on each leg, and only abnormally two.

The head is crested in both sexes, and the sides of the head are bare and highly coloured.

KEY TO SPECIES: MALES.

A. Crest white light brown	*albocristatus.*
B. Crest black.	
a. Upper plumage black, feathers with pale edges, and rump barred with white, breast largely whitish	*leucomelanus.*
b. Upper plumage wholly black, breast largely whitish	*melanonotus.*
c. Upper plumage black; rump boldly barred with white; breast black	*horsfieldi.*
d. Upper plumage grey, formed by narrow vermiculations and bars of black and white	*lineatus.*
e. Upper plumage almost white with sparse, narrow bars of black...	*nycthemerus.*

KEY TO SPECIES: FEMALES.

A. Lower plumage more or less mottled or squamated and with pale shafts but not with white or buff streaks.	
a. Rather paler below...............	*albocristatus.*
b. Rather darker below.	
a′. Central tail feathers well mottled and distinctly grey about neck	*leucomelanus.* *melanonotus.*
b′. Central tail feathers not much mottled and no grey on neck.	
a″. Central tail feathers dark chestnut, contrasting greatly with lateral ones..	*horsfieldi horsfieldi.*
b″. Central tail feathers pale chestnut, contrasting greatly with lateral ones.	*horsfieldi williamsi.*
B. Lower plumage with white or buff and not squamated	
c′. Central streaks buff and confined principally to breast and flanks	*lineatus oatesi.*
d′. Central streaks white, numerous everywhere, but narrow; under plumage bright rufous.	*lineatus lineatus.*
e′. Central streaks white and broad, lower plumage much darker and not so rufous	*lineatus sharpei.*
C. Lower plumage white, buffy white, or buff with bold bars, or edges of dark brown.	
f′. Lower plumage white ...	*nycthemerus nycthemerus.*
g′. Lower plumage buff or buffy white	*nycthemerus ripponi.* *nycthemerus rufipes.*

The above key is one which can only be accepted as a general guide, for in each of the three groups the females resemble one another so closely that it is often difficult and sometimes impossible to distinguish one from the other. The three groups are themselves well separated by the markings of the lower plumage in quite adult birds, but the young females of *B* and *C* are sometimes very close to one another in appearance until the *nycthemerus* group have acquired the pale, dark margined plumage in part or whole.

GENNÆUS ALBOCRISTATUS.

The White-Crested Kalij.

? Phasianus hamiltonii, Gray, in Griffith, ed. Cuvier III., p. 27 (1829); id. Ill. Ind. Zool. I., Pl. 41 (1830).

Phasianus albocristatus, Vigors, P. Z. S., p. 9 (1830); Gould, Gen. B. H., Pls. 66-67 (1832).

Euplocomus albocristatus, Hutton, J. As. Soc. Beng. XVII, pt. II, p. 693 (1848); Blyth, Cat. Mus. Asiat. Soc., p. 244 (1849).

Euplocamus albocristatus, Adams, P. Z. S., p. 499 (1858); Elliot, Mon. Phas. II, Pl. (1872); Hume and Inglis, St. Feath. V., p. 42 (1877); Hume, ibid, VII., p. 429 (1878); Hume and Marsh, Game—B. I, p. 177, Pl. (1878).

Euplocamus albicristatus, Oates, ed. Hume's Nest and Eggs III, p. 413 (1890).

Gallophasis albocristatus, Mitch., P. Z. S. (1858), p. 544, Pls. 148, fig. 1 and 149, fig. 3; Jerd., B. of In, III, p. 532 (1863); Hume, Nest and Eggs, In. B., p. 526 (1873); Marsh, Birds' Nests Ind., p. 58 (1877).

Gennæus albocristatus, Ogilvie-Grant, Cat. Birds B. M. XXII, p. 298 (1893); id. Hand—L., Game—B. I, p. 258 (1895); Stuart Baker, Jour. B. N. H. S., XXIII, p. 666 (1915).

Gennæus albicristatus, Oates, Game—B. I, p. 324 (1898); Blanf., Fauna B. I. Birds IV., p. 89 (1898); Oates, Cat. Eggs B. M. 1, p. 54 (1901); Rattray, Jour. B. N. H. S. XVI., p. 663 (1905); Ghigi, Mem. Acad., Bologna (6), V., p. 145 (1908); Magrath, Jour. B. N. H. S. XVIII., p. 298 (1908); "Pine Marten," ibid, XIX., p. 796 (1910).

Vernacular Names.—Kalij, Kukera, Mirghi Kalij, Kulesur ♂, Kalesi ♀ (*Hin. In various parts of the N. W. Himalayas*) Kolsa, (*Western Punjab and Chamba*).

Description—Adult Male.—Forehead, feathers above the eye, cheeks, nape and neck black glossed with purplish-blue. Long hairy crest white or dirty pale brown, the feathers next the forehead and sides of the crown mixed with darker brown and black, so that these parts merge into one another rather than contrast. Feathers of the upper back like the neck, but more blue than purple in sheen and with dull edges of pale brown or whitish. Lower back, rump and upper tail-coverts black glossed with steel-blue and with broad edges of pure white generally divided from the black by a very narrow band of brown. Tail feathers above glossy blue-black, below dark brown, sometimes with pale tips. Chin, throat and foreneck dark brown with pale shafts, gradually changing into grey on the lower foreneck, which has a pale steel-blue sheen, and again into white tinged more or less with brown on long lanceolate feathers of the breast and flanks. Abdomen, vent under tail-coverts dull brown, more or less edged paler and not distinctly defined from breast or flanks. Lesser and median wing-coverts like the feathers of the back, and like them with nearly white shafts and two fairly well-marked areas of green and blue gloss; greater coverts with a greener gloss and visible shafts dark. Quills dark brown glossed on the visible portions with green.

The feathers of the breast are all brown at the base, and shew up in varying degrees, so that in some birds the breasts appear almost pure white, whilst in others they appear almost more brown than white.

Colours of soft parts.—

> " Legs and feet pale drab; bill pale horny green, cere dusky; " bare face space crimson, irides deep brown." (Davison).
>
> " The irides are orange brown; the bare eye patch bright " scarlet to deep crimson, dotted over with numerous tiny tufts " of abortive black feathers; the bill greenish white, dusky at " tip; the legs and feet livid white, with a purplish or brownish " tinge, varying to pale brown, often with an olive tinge." (Hume).

I have also had the legs described to me as being of a rather pale slaty or plumbeous colour.

Measurements.—Length about 27″ (685·8 mm.); wing from 8·5″ to 9·8″ (215·9 to 248·9 mm.); average of forty birds 9·05″ (229·8 mm.); tail from 9·0″ to 12·5″ (228 to 327 mm.); tarsus about 3·1″ (78·7 mm.); bill at front about 1″ (25·4 mm.), and from gape 1·4″ (35·5 mm.). The crest runs up to 4½″, and is generally about 3″ to 3½″ (76·2 to 88·9 mm.)

> " Length, 24·0 to 29·0; expanse, 28·75 to 32·0; wing, 8·7 " to 10·0; tail from vent, 10·2 to 13·0; tarsus, 2·9 to 3·1; bill " from gape, 1·3 to 1·55; weight, 2-lbs. to 2-lbs. 6 ozs." (Hume).

Adult Female.—Feathers of the head, including crest, reddish hair brown, the shafts but little paler than the webs. Wing-coverts and the whole of the neck and back the same brown, but with each feather broadly edged with very pale brown and with the shaft pale enough to contrast strongly with the webs. Wing quills brown with the shafts the same colour except on the innermost, which have them a little paler than the webs; the whole of the back and wings finely vermiculated with black, the vermiculations being somewhat stronger towards the tip than at the base ot each feather. Central tail feathers reddish brown, more broadly vermiculated with black and with a few buff or whitish vermiculations on the outer edges of each web; sometimes extending over the whole of the outer webs. Remaining tail feathers dark brown, glossed with green, and generally with paler tips, whilst one or two pairs next the central ones often have edges similar to these. Lower plumage similar to the upper, but paler and with broader pale edges to the feathers; chin and throat palest and dullest, and centre of breast darkest and richest in colouration; centre of abdomen and vent dull grey-brown, pale and feebly marked.

The females vary a good deal in tint, and a few are markedly more grey, especially on the wing quills and scapulars.

Colours of soft parts are similar to the same parts in the male, but generally duller. The crimson of the bare parts of the face is duller and darker, more a brick-red than a true crimson or scarlet red; the irides are brown, or orange-brown; legs and bill much the same as in the cock bird.

Measurements.—The female is generally a good deal smaller than the male, but varies very much in size. Wing from 8″ to nearly 9″ (203·2 to 226·5 mm.); average of thirty-three birds, 8·3″ (210·8 mm.); tail from 7·8″ to 9·1″ (198·1 mm. to 229·0 mm.); tarsus about 2·6″ (66 mm.); crest about 3″ (76·2 mm.) or a little over.

> "Length 20·0 to 23·0; expanse 24·5 to 27·2; wing 8·0 to "8·3; tail from vent 7·8 to 9·0; tarsus 2·6 to 2·8; bill from "gape 1·2 to 1·3; weight 1 lb. 4 ozs. to 2 lbs. 4 ozs." (Hume).

Young Male.—Similar to the female.

Chick in first plumage has the crown chocolate brown, with the sides of the head and crown rufous, pale on former, rich and somewhat chestnut on the latter; ear-coverts dark-brown; upper plumage brown, minutely freckled with black, each feather with paler edging, a conspicuous white spot at the tip, and a broad subterminal bar of black edged with rufous; wing-coverts like the back. Lower plumage dull pale brown, the feathers with whitish shafts and pale edges.

Distribution.—Along the Himalayas from the River Indus on the West to Nepal on the East, possibly entering the extreme West of Nepal as far as the Gogra. Hodgson obtained a skin from West of Jamla, presumably in Nepal, but with no definite locality, and Hume thought that it must have come from still further West, probably from the Kumaon or Garhwal Hills, where it is very common.

It has been said to extend West into Buneer and Swat, but it is very doubtful if this report is correct, for the country is certainly not suited to the habits of these birds.

Nidification.—The White-Crested Kalij breeds according to locality from the end of March and early April to the end of June. From 2,000 feet to 4,000 feet or so most nests will be found during April, but at 6,000 feet not many will be taken until well on into May, and in the highest parts of their breeding ranges their eggs may be found as late as the end of June. They certainly breed up to 9,000 feet and over, and probably up to some 11,000 feet in parts of Kashmir. Magrath records it as a resident bird at Thandiani at an elevation of 9,000 feet, and Dodsworth found it breeding at over this height in the Simla Hills and Native States, whilst

Wilson took its eggs at 9,500 feet in the Bhagiruttee Valley. Hume found it, on the other hand, breeding as low down as 1,200 feet in the Dhoon, and doubtless it may be found at even lower elevations than this.

The nest is much the same as that of all others of the genus, *i.e.*, generally nothing more than a collection of leaves, grass and forest rubbish in some hollow under the shelter of a bush, tree or bamboo clump. In many instances this heap of rubbish is merely what has fallen and drifted into its present situation, but sometimes apparently the bird does go to some trouble in scratching together the material on which to deposit its eggs.

Mr. Frederick Wilson, so well known under the nom-de-plume of "Mountaineer", in an interesting letter to Hume writes about the breeding of this pheasant in Garhwal as follows:—

> "The Kalij Pheasant (*murghi* or *kookera* of the Paharis) is "found from the foot of the hills, or rather from the Sewalik "Range to the Snows, and consequently breeds at all eleva-"tions up to 9,000 feet in a few localities even higher; I "lately found the nest above the village of Sookee in the "Bhagirattee Valley, which must have been at 9,500 feet. In "the Dhoon, at the foot of the hills in the lower Valleys the "Kalij begins to lay in April. In the higher ranges it lays "in May, and some birds not till the beginning or middle of "June. The nest, if it can be called such, is generally in a "coppice where there is plenty of underwood, and under an "overhanging stone, or thick low bush, or tuft of grass. It is "merely a hole scraped in the ground. The eggs are 9 to 14 "in number, very like those of some domestic fowls, a yellow-"ish or buffy white. Both parent birds are generally found "with the young brood. Occasionally very late broods would "lead one to infer, either that the Kalij sometimes has two "broods in the year, or that when a nest is destroyed, they "commence the business of incubation over again."

Other observers' remarks agree well with Wilson's description of their breeding, but Major Cook once found its nest on a large low bough of a tree in a hollow on the upper side of which the eggs were placed.

The only two things which seem to be an absolute necessity in this Pheasant's estimation in the nesting site is ample cover and water within a reasonable distance. Thin forest with thick undergrowth, evergreen forest with plenty of ferns, brambles and bracken, ravines and water courses with rocky sides well covered with weeds, &c., all seem to form equally suitable places for the nest, and in addition to these it may be sometimes found in bamboo jungle, especially if there is a certain amount of grass or scrub mixed with it. According to Hume, the White-Crested Kalij sometimes makes quite a respectable nest. He remarks:—

> "The Common Kalij hardly forms a regular nest. It "gets together a pad, sometimes rather massive, sometimes "very slight, of fine grass and coarse moss roots, mingled "with a little grass or a few sprigs of moss, and in a "slight depression; in this it lays its eggs. One which I "measured *in situ* in May, 1871, in the Valley of the Sutlej, "just below Kotegurh, was circular, 11·5 in diameter and "4 inches in thickness outside, with a central depression "6 inches wide and nearly 2 inches in depth in the "centre."

The number of eggs generally laid is, 6 to 9, but they sometimes lay as many as 14, and also sometimes as few as 4, as the late Mr. P. Dodsworth took this number of eggs very hard set. 8 or 9 eggs is probably the number most often to be found in a complete clutch.

In general appearance they are exactly like the eggs of the domestic fowl, but are, perhaps, on the whole more glossy, and are frequently somewhat pointed. The surface is very smooth with a fine, close grain, but sometimes they are pitted with innumerable little pores, though these are not normally nearly so numerous or so conspicuous as those almost invariably found in the eggs of the Peacock Pheasant.

The colour may be anything from a white merely tinted with cream or buff to a buff of a rich red tone like that of the darkest eggs laid by a Brahma fowl. but even redder than these. The majority of eggs laid are a warm cream or reddish buff, and eggs almost white are quite exceptional.

The series of 60 eggs in the Hume Collection in the British Museum vary in length between 1·85″ (44·0 mm.) and 2·05″ (52·07 mm.), and in breadth between 1·25″ (31·7 mm.) and 1·55″ (39·4 mm.). All the eggs which have passed through my hands come within these extremes, and including the 60 in this Collection the average of 100 is exactly 1·95″ (49·5 mm.) by 1·42″ (36·1 mm.).

Whether the White-Crested Kalij is polygamous or not seems still to be a moot point, and it is quite possible that though it is generally speaking monogamous, it sometimes indulges in mormanistic habits. Hume is strongly of opinion that it is a libel upon this bird to accuse him of having more than one wife, and says that he has many hundreds of times flushed young broods in company with both parents, and that from the month of May to that of October he has rarely put up an adult of one sex without finding the pair to it close by.

"Onithognomen," however, who wrote regularly for the *Field* in the early sixties, and was a sportsman and observer of wide experience and considerable ability, recorded:

> "The Kullij is polygamous (as indeed all Gallinaceous birds "are), and its habits with respect to breeding are exactly the "same as those of the Jungle-Fowl. The cock bird pays "tolerably impartial attention to his seraglio of 3 to 5 hens, "and the latter, when so disposed, retire from time to time to "some secluded, sheltered spot to lay, returning to their party "when this little duty has been performed. When 6, 8 or 10 "eggs have been laid in one spot, the hen yields to the impulse "of incubation, and withdraws from Society to hatch her "brood."

It must be remembered that in "Onithognomen's" day it was an accepted idea that all game birds were polygamous, and the barndoor fowl was cited as the pattern followed by the rest in their domestic habits. Of recent years, however, it has been satisfactorily proved that in many instances the cock birds of many species prove faithful husbands and good parents, and it is not safe to generalise. The credit for polygamy has doubtless arisen from the fact that the cock bird is so often seen with a number of birds in hens' plumage, though this may be due merely to the young cocks not having yet acquired their male feathers and colours.

The young grow their wing quills with extraordinary quickness, and within a few days are able to fly as well and as fast as the adult bird.

The hen bird is a very close sitter, and according to Hume, may often be captured by hand or seized by a dog before she will leave her nest.

General Habits.—The White-Crested Kalij is resident wherever found, though it may move locally higher up the hills in summer and lower down in winter. Even this movement must, however, be but very slight, as it has been found breeding at practically every height at which it has been seen. Typically it is, like the rest of the genus, a bird of heavy forests and thick growths rather than the deciduous forest and more open country of the higher hills. At the same time it is less exclusively found in dense evergreens than are its nearest relations, and sometimes at least it wanders on to hill sides covered with but broken patches of tree and bush scrub, especially if the intervening portions are well furnished with bracken. Of course this does not mean to infer they do not feed regularly, morning and evening, in the open, and indeed when the weather is cool and showery especially at the higher elevations, it may be found in open places throughout the day.

It is not nearly so socially inclined a bird as the Jungle-Fowl, and is seldom met with except in pairs or small family flocks of half a dozen to a dozen, but may sometimes be seen in the company of Jungle-Fowl, and sometimes two or three old cocks will be found together after the breeding season is over.

During the breeding season they are said to be very pugnacious. "Mountaineer" writes:

> "The Kalij is very pugnacious, and the males have frequent "battles. On one occasion I had shot a male, which lay "fluttering on the ground in its death struggles when another "rushed out of the jungle and attacked it with the greatest "fury, though I was standing re-loading the gun close by. "The male often makes a peculiar drumming noise with its "wings, not unlike the sound produced by shaking in the air "a thick piece of cloth. It is only heard in the pairing "season; but whether to attract the attention of the females "or in defiance of his fellows I cannot say, as I have never "seen the bird in the act, though often led to the spot where "they were by the sound."

The sound is undoubtedly one resorted to as a challenge to fight, and in some parts of its habitat it is imitated as a decoy to entice the male birds into snares and traps.

Nowhere do these birds exist in sufficient numbers now-a-days to make their pursuit worth while unless other game can be bagged at the same time. When this is the case they are well worth working hard for, as they are strong fast fliers when fairly on the wing, take a lot of bringing down, and when killed are excellent for the table.

Hume remarks that :—

> "Generally in the hills you may pick up three or four birds "in a day, by beating all likely patches of cover near fields, "but it is rare with this species to make a good bag. There "are, however, places where you may come across the Kalij "almost as thick as Pheasants in a Norfolk cover. Such "places there used to be close to Bhim and Naukuchia Tal, "small lakes not far from Naini Tal, but at a much lower "level, and at the former of these I once, early in November, "killed eleven and a half brace in less than three hours."

Wilson writes of this Kalij as a very tame and confiding sort of bird; he says:

> "It appears to be more unsuspicious of man than the rest of "our Pheasants; it comes much nearer his habitations."

And again:

> "They are never very shy, and where not unceasingly "annoyed by sportsmen or shikaris, are as tame as any sports-"man could wish."

Since the days when Wilson wrote the Kalij has evidently learnt a lot, and now one requires plenty of patience and hard work to be expended before he can be brought to bag, especially without good dogs. Wandering along roads and forest paths in the early morning or late afternoon, one may sometimes obtain quite a decent bag of these birds, for wherever the road passes through forest, Kalij Pheasants are quite sure to frequent it daily. If the road is wide and runs straight for considerable distances, it is not much used attempting to shoot along it, and the only chance is to creep along as quietly as possible just inside the edge of the forest and *hope* to spot your game before he sees or hears you. On the other hand if the road twists and turns so as to enable you to get fairly clear to any bird hunting for grain in the droppings, &c., on it, one can get quite a number of shots in a couple of hours' stroll. This is not however a very satisfactory way of shooting, for if you want your bird, it is almost imperative to shoot him as he runs into safety, and not one bird in five will give a decent shot on the wing unless he is startled into unwilling flight by your almost treading on him.

If, however, you know his haunts and have good dogs to work them with, it is possible to have a much more sporting day's shoot, but it must be remembered that Indian forests are not like English ones, there are no nicely cut drives or open spaces, and ten to one when the bird is put up by your dogs he gets up and keeps up right out of sight. A more or less open ravine may sometimes furnish a vantage ground for the sportsman, giving him room to work uphill and see more or less what is going on above him on either side. It is best always to work uphill, as all Kalij Pheasants, like Jungle-Fowl, always run away uphill, but once they are flushed turn and fly downhill. Once on the wing and fairly started, they fly at a great pace, and it is no easy matter to get your first bird as they come towards you and then swing round and bowl over your second before he passes out of shot.

When shooting with dogs, pheasants often fly into trees and perch, and once seated in what they consider safety, it is generally possible to creep up and get a fair shot as they leave their perch.

The White-crested Kalij feed greedily on all kinds of grain and seed, and also on the tender young shoots of many green crops. Cultivation of almost any sort, therefore, forms a great attraction to them, and this is probably why they are more numerous round and about villages than in more remote forests. At the same time even the crops of villages will not tempt them unless there is plenty of heavy forest within the immediate vicinity into which they can scuttle for refuge. In addition to vegetable food they will eat almost any kind of insect, worms, larvæ and even small reptiles.

The cocks have a rather loud crow or call, described by Wilson as "a loud whistling chuckle or chirrup," and both sexes chuckle and cluck in a soft undertone as they wander about in the undergrowth scratching for food.

GENNÆUS LEUCOMELANOS.

The Nepal Kalij.

Phasianus leucomelanos, Lath., Ind. Orn. II., p. 633 (1790).

Euplocomus leucomelas, Hodg., in Gray's Zool. Misc., p. 85 (1844).

Gallophasis leucomelanos, Gray, Gen. B. III., p. 498 (1845); Hutton, J. A. S. B., XVII., pt. II., p. 694 (1848).

Euplocamus leucomelanus, Hume, Str. Feath. VII, pp. 428-9 (1876); Hume and Marsh, Game-B. Ind. I., p. 285, Pl. (1878).

Gallophasis leucomelanus, Scully, Str. Feath. VIII., p. 345 (1879).

Gennæus leucomelanus, Ogilvie-Grant, Cat. Birds B. M. XXII, p. 380 (1893); id. Hand-L. Game-B. I., p. 262 (1895); Oates, Man. Game-B. I., p. 329 (1898); Blanford, Fauna. Brit. In. IV., p. 90 (1898); Stuart Baker, Jour. B. N. H. Soc. XXIII., p. 667 (1915).

Gennæus leucomelanos, Ghigi, Mem. Acad. Bologna (6), V., p. 145 (1908).

Vernacular Names.—Kalich, Kalij (*Perbuttia*), Rechabo (*Bhutea, Nepal*).

Description—Adult Male.—Similar to *albocristatus*, but with the crest glossy blue-black with no trace of white or of pale brown. The feathers of the lower back, rump and upper tail-coverts are glossy, blue-black with narrow white edges divided from the black by a very fine bar of brown vermiculations. The wing-coverts have narrower white edges than are found in the White-Crested Kalij, and these are often in the shape of white vermiculations rather than in one distinct bar. The chin and foreneck are darker and more glossy, and the under parts are generally a little less albescent, though this feature is not sufficiently developed to be of any real value.

Colours of soft parts, as in *albocristatus*. Hume describes the legs and feet thus:—

> "Legs and feet pale brownish or dingy greyish horny; the
> "toes usually a little darker than the tarsus; claws brownish
> "horny, spurs dusky."

Measurements.—Length about 25″ (637·0 mm.); wing 8·1″ to 9·2″ (204·7 to 233·6 mm.); average of thirty-five birds, 8·3″ (210·8 mm.); tail 8·9″ to 12·0″ (248·9 to 304·8 mm.); tarsus about 3·1″ (78·7 mm.); crest 2·5″ to 3″ (71·1 to 76·2 mm.). Hume gives the weight as varying between 1-lb. 12-ozs. and 2-lbs. 8-ozs.

Adult Female.—Differs but little from the female of the White-Crested Kalij, but is on the whole rather redder and more richly coloured, and this more particularly so on the tail and the under parts. The feathers of the breast have quite dark centres such as are never found in *albocristatus*, and the general darker tint of the centre of the feathers of both upper and lower plumage makes the contrast with the pale edges more striking than it is in that bird. Scully says that:—

> "The adult female resembles that of *melanotus* much more
> "closely than it does that of *albocristatus* or *horsfieldi*. It

> "differs from *melanonotus* in having the feathers of the upper "surface more broadly margined with greyish white; the "middle tail feather more broadly vermiculated, though not so "prominently as in *albocristatus*; the edges to the feathers of "the lower surface contrast more and the rump contrasts more "with the middle tail feathers, in this respect resembling "*horsfieldi*, but in no other."

Colours of soft parts as in *albocristatus*.

Measurements.—Length about 20" (508 mm.); wing 7·8" to 8·7" (198·1 to 221·0 mm.); average of twenty birds, 8·1" (205·7 mm.); tail 7·3" to 8·6" (185·4 to 218·4 mm.); tarsus about 2·7" (68·5 mm.); crest about 2·5" (63·7 mm.).

Chick in down.—Head chestnut, palest on forehead and behind eye; a dark streak running from behind and below eye to neck. Centre of back chocolate brown with broad lateral bands of pale buff, sides dull chestnut; chin and throat pale yellowish white, remainder of lower parts pale yellowish grey.

> "*Young.*—A chick captured on the 10th June, whose wing "measured only 2" had the feet orange and the bill greenish "yellow-horny; the head was rufous-brown, the body above "dark brown; each feather of the wing-coverts and scapulars "having a blackish subterminal bar, and a fulvous tip; beneath "sullied fulvous. Young birds of both sexes about three "months old resemble the female, but have the bill livid at "tip, the orbital skin pale fleshy red, and the feet livid "brownish; at this stage the black subterminal bars on the "upper feathers are still well marked. The young male "assumes the black plumage when about five months old "(such, at least, was the case in two specimens I had in con- "finement); but at this age it still shews traces of the original "brown colour about the feathers of the neck and upper "back." (Scully).

Distribution.—Nepal at practically all heights between 2,000 and 9,000 feet. In the extreme West of Nepal across the Gogra it is doubtful whether this species may not be replaced by the White-crested Kalij, and again, in the extreme East of Nepal it is possible that the Black-backed Kalij may be found.

Scully writes that the Nepal Kalij extends as far East as the Arun River, and this is probably correct; certainly birds which I procured at Jalpaiguri, and which had come from the vicinity of Dhamkhata were all *melanonotus*. Dhamkhata is a village on the Tamra, a small stream running into the Arun River, and the birds were collected for me by Nepalese who traded in Pankabari and Jalpaiguri. It is interesting to note, also, that these birds shewed no signs of grading into *leucomelanus*. It is true that one or two shewed white lines on the edges of the rump feathers, but I find that this is a feature which crops up here and there throughout the whole range of *melanonotus*.

Nidification.—As far as I can ascertain there is nothing authentic on record about the breeding of this Pheasant. Scully says nothing about their nesting habits. Hume says:

> "The habits and nidification of this species are, of course,
> "very similar to those of the other Kalij Pheasants."

This, however, in so far as it relates to the nidification is merely guess work on Hume's part, though undoubtedly correct. Ogilvie-Grant says of the nest and eggs "very similar to those of *G. albocristatus*", a statement very possibly founded on Hume's.

There are no eggs of this species in the British Museum, nor did Hume ever obtain any, and I think the first eggs ever taken were two brought to a Mr. Ferry by Nepalese from the hills immediately above Bettiah. These were given by him to Dr. H. N. Collart, who in turn made them over to me. Later I obtained a second clutch of five eggs from the same place together with the skins of the females.

In appearance the eggs cannot possibly be distinguished from those of the other Kalij Pheasant; the surface, texture and shape are all quite normal. In size they vary in length between 53·1 mm. and 46·2 mm., and in breadth between 34·2 mm. and 31·1 mm., the average of eighteen eggs being 50·4 mm. by 33·6 mm. The two clutches were taken on the 23rd May 1908, and 25th June 1907, respectively.

Habits.—The Nepal Kalij Pheasant is a bird of comparatively high elevation, for though in the cold weather it wanders down to some 2,000 feet and even to the foot hills still lower than this, it is most common between 4,000 and 6,000 feet, seldom breeding below the former level, whilst it is common up to 9,000 feet and perhaps even higher.

Hodgson has left little on record about this Pheasant, and was in fact somewhat doubtful as to its status. He remarks:

> "This is by far the commonest Pheasant in Nepal. Its
> "range is the central region; it is never found in the Terai,
> "seldom in the Cachar (the most elevated portions of Nepal).
> "Where *Gallus ferrugineus* ends there the Kalij begins and
> "extends, though in diminishing numbers, to the region of
> "the Monal and the Tragopan."

The notes of Scully in "Stray Feathers" written in 1880 are still practically the only record we have of this bird's habits, and are quoted as follows:—

> "*G. leucomelanus* is common, wherever thick forest is found,
> "from Hetoura in the Dun to the Valley of Nepal; in all the
> "wooded hills surrounding the latter up to an elevation of
> "nearly 9,000 feet; and in every forest about Noakote. It is

"usually seen in pairs or in parties of from 3 to 10, often "feeding on the ground near cultivated patches at the border "of forest. The birds seem very fond of perching on trees, "and it is usually in this position that one comes across them "in forcing one's way through forest which has a dense undergrowth. On such occasions the Kalij first gives notice of its "whereabout by whirring down with great velocity from its "perch and then running rapidly out of sight to the shelter of "some thicket. In the winter the birds roost on trees at the "foot of the hills, and the plan for making a bag is to post "oneself about sunset under some trees which they are known "to frequent and to await their coming. The birds are then "soon heard threading their way through the jungle to their "favourite trees, and at once fly out and perch. When once "settled for the night in this way they are not easily alarmed, "and I have shot 4 or 5 birds in quick succession before the "rest of the party would clear out to quieter quarters.

"Occasionally too one can get a shot at the Kalij as they "cross a hill path through the forest on their way to or from "some streams.

"Great numbers of the Nepal Kalij are snared and brought "into Khatmandu for sale; the birds bear confinement in the "valley very well, and I reared several chicks to maturity."

GENNÆUS MELANONOTUS.

The Black-backed Kalij Pheasant.

? *Phasianus muthura,* Gray, in Griffiths' Ed. Cuv. III., p. 27 (1829).

? *Gallophasis muthura,* Gray, Gen. Birds III., p. 498 (1845).

Euplocamus melanonotus, (Blyth) Hutton, J.A.S.B. XVII., pt. II., p. 694 (1848) (Darjeeling); Blyth, Cat. Mus. As. Soc., p. 244 (1849).

Gallophasis melanonotus, Mitchell, P.Z.S. (1858), p. 544, Pl. 149, fig. 2; Jerdon, B. of Ind. III., p. 534 (1863); Hume, Nests and Eggs, Ind. B., p. 527 (1873); Marshall, B. Nests Ind., p. 59 (1877).

Euplocamus melanonotus, Hume and Inglis Str. Feath., V., p. 42 (1877); Hume, ibid VII., p. 429 (1878).

Euplocamus melanonotus, Hume and Marsh., Game-B. Ind. I., p. 191 (1878); Oates, ed. Hume Nests and Eggs III., p. 415 (1890).

Gennæus muthura, Ogilvie-Grant, Cat. Birds B.M. XXII., p. 301 (1893); Ghigi, Mem. Acad. Bolongna (6), V., p. 145 (1908).

Gennæus melanonotus, Ogilvie-Grant, Hand-L. Game-B. 1, p. 263 (1895); Oates, Man. Game-B. Ind. 1., p. 331 (1898); Blanf., Fauna B.I. IV., p. 91 (1898); Oates, Cat. Eggs B.M. I., p. 54 (1901); Stuart Baker, Jour. B.N.H. Soc. XXIII., p. 668 (1915).

Vernacular Names.—Kar-Rhyak (*Lepcha*).

I follow Blanford in refusing to accept *muthura* as the specific name for this Pheasant. The description is that of a bird "the size of a turkey" which is, of course, too big for any of the Kalij Pheasants; this, however, would not debar the name if the description was otherwise sufficient, for there is no doubt it is meant to apply to one of the Kalij Pheasants, but the description does not suffice and moreover the trivial name employed "The Chittagong Pheasant" would seem to shew that it is equally as likely to be the Black-breasted Kalij as the Black-backed bird. Under these circumstances I retain Blyth's name of *melanonotus* as the earliest certain name for this Pheasant.

Description—Adult Male.—Whole upper plumage black, glossed with deep violet blue, greenish in some lights and slightly purplish in others, each feather from the hind neck to the shorter tail-coverts with an unglossed velvety black edge to the tip, broadish on the rump, and also with white shafts; these white shafts shew up well on the scapulars and upper back, but are often almost entirely concealed on the rump and upper tail-coverts. Longest upper tail-coverts and tail feathers black-glossed with blue-green or green. Wing-coverts like the back; quills brown, the outer secondaries glossed with greenish violet on the outer webs and the innermost glossed with the same on both webs.

Chin and throat blackish brown, the tips of the feathers next the breast gradually becoming paler; the long lanceolate feathers of the breast white with brown bases, the white decreasing and the brown increasing in extent towards the lower breast, abdomen and posterior flanks; vent and extreme centre of abdomen brown; under tail-coverts and thighs blackish brown.

Many fine males have the scapulars and wing-coverts very narrowly edged with white, in some the white being pure and well-defined, and in others more or less broken up with velvety black. In two specimens in the Hume Collection the feathers of the scapulars have small smoky white spots at the tips of the feathers instead of distinct white edges.

The under parts of individuals of this species vary considerably, in some specimens the white portions of the feathers are so extensive that the whole breast appears to be white, whilst in others the brown bases shew through everywhere, giving this part of the plumage a mottled brown appearance.

Colours of the soft parts.—Iris brown, hazel brown to orange brown; facial skin and lappets crimson red, bright red, or crimson; bill yellowish or greenish horny, palest at the tip, and blackish at the base as far as the nostrills; legs and feet pale horny brown, greenish brown or fleshy slate; spurs paler than the legs at the base, then darker, and usually with a light tip; the soles are generally pale fleshy slate colour.

Measurements—

> "Length 25·0 to 24·0; expanse 26·5 to 29·0; weight "2-lbs. 6-ozs. to 2-lbs. 12-ozs." (Hume).

Wing 8·5″ to 9·5″ (215·9 to 241·3 mm.); average of forty birds, 8·94″ (227·0 mm.). Tail 9·4″ to 12·3″ (238·7 to 312·4 mm.); average of forty birds, 11·2″ (284·4 mm.); tarsus 3·1″ to 3·3″ (78·7 to 83·8 mm.); spur about ·75″ (16·9 mm.); bill at front 1·20″ (30·5 mm.) and from gape 1·35″ (34·2 mm.): crest up to 3″ (76·2 mm.); generally about 2½″ (63·5 mm.).

Adult Female.—Only differs from the female of *leucomelanus*, in having the nape a less bright chestnut than the crest and upper back, so that when the crest lies down it shews quite plainly against it. On the whole it is like *leucomelanus* perhaps, darker than *albocristatus*, and has the tail feathers more chestnut.

Colours of the soft parts as in *leucomelanus*.

Measurements—

"Length 18·0 to 21·0; expanse 25·0 to 27·0. Weight "1-lb. 14-ozs. to 2-lbs. 4-ozs." (Hume).

Wing 7·7″ to 8·8″ (195·5 to 223·5 mm.); tail 7·9″ to 9·2″ (200·6 to 233·6 mm.); tarsus 2·7″ to 2·9″ (68·5 to 73·6 mm.); bill at front about 1·15″ (29·2 mm.), and from gape about 1·25″ (31·7 mm.) The crest is roughly about 2″ (50·8 mm.), and rather scanty.

Young Male in first plumage resembles the female, but is generally darker below.

A young bird of a few months old—probably about three—has the greater and median wing-coverts reddish brown with fine bars of black vermiculation, a broad bar of black near the tip, then a bar of chestnut with one fine bar of black on it, and finally a white tip; a few feathers of the back and scapulars have bold black bars; the rest of the plumage is that of a very dull adult female.

Distribution.—From the extreme West of Sikkim and over the greater part of Western Bhutan. Its exact boundaries both East and West have not hitherto been defined. To the West the Arun River in Nepal is *probably* its Western boundary, for, as already recorded, some birds sent me from a small Eastery tributary of this stream were all of this species. At the same time exact data of native-collected specimens are always to be regarded with caution. In this instance they are probably correct, as they were alleged to have been trapped within a short distance of the village to which the Nepalese belonged. The birds found in the hills North of Jalpaiguri are all typical *melanonotus*, but North of Goalpara one gets into the range of *horsfieldi*, though birds of this district often shew traces of white on the breast, as is, however, the case throughout the whole of the range of typical *horsfieldi*. These are the birds named *mearsi* by Oates, the type of which was killed at Nanywa, Chin Hills.

Nidification.—The Black-backed Kalij breeds from late in March up to the end of June, but eggs may also be taken a good deal earlier than this, and also later. In the lower elevations at which these Pheasants bred, say from 1,500 to 3,000 feet, March and

April are the two months in which most eggs are laid; from 3,000 to 4,500 feet, the 25th April to end of May or early June are the favourite breeding months, whilst in the highest ranges they breed from May to the end of June, or even July, and I have had hard-set eggs sent me which were taken in August below Darjeeling.

The nest is generally a very poor affair, nothing more than a collection of dead leaves and grass gathered together by chance—less often by the birds themselves—lying in some natural hollow under the protection of a bush or tree. They are also sometimes found in bamboo jungle, and in these cases the birds seem to scratch a hollow in the ground, and fill this with bamboo spates and leaves, then they work a hollow in the centre of these for the reception of their eggs. I have never seen a nest of this species myself, but all my correspondents agree that the nests are almost invariably very well concealed; favourite positions for them are either in ravines, in dense evergreen forest, or in the almost impenetrable secondary growth, which in a couple of years covers deserted cultivation. When bamboo jungle is selected, it is nearly always very closely growing, and the eggs are deposited well in amongst the roots, so that they are not easily spotted.

They also sometimes make their nests in among tea-bushes in Tea Gardens after these have come into full flush, and the undergrowth has sprung up again so as to afford sufficient cover. I imagine, however, that few of these clutches of eggs ever hatch out, for nowadays tea is so highly cultivated that the weeds are constantly hoed out, and the eggs are then discovered and eaten by the coolies. At the same time there is yet plenty of land in the Terai all round about the Tea Estates which is too broken up to be worth cultivating for tea, and here the Kalij still flourishes and breeds without much molestation, for the small native boy does not emulate his white brother in his birds' nesting proclivities. Thus Hume's fear that within a few years of his writing his "Game-Birds," the Black-backed Kalij would become very rare, has fortunately not been fulfilled.

The eggs vary in number from 6 to 10, 7 or 8 being the numbers most often found. They differ in no way from those of other Kalij Pheasants, that is to say, they are very similar to the eggs of the common domestic fowl. In colour they vary, as do these, from practically pure white, as recorded by Tickell, and seen also by myself, to a warm, rich café-au-lait or buff, whilst they cover the same differences in shape, being normally a broad oval, but slightly compressed at the smaller end. The texture is that of a fowl's egg, usually quite smooth and slightly glossy, sometimes pitted, sometimes having the tiny white specks occasionally found in most game-birds' eggs.

The eggs I have seen, including Hume's series in the British

Museum, vary in length between 1·76″ (44·0 mm.) and 2·05″ (52·0 mm.), and in breadth between 1·36″ (34·5 mm.) and 1·54″ (39·1 mm.), the average of 58 eggs being 1·92″ (48·7 mm.) by 1·47″ (37·3 mm.).

Habits.—The Black-backed Kalij is a bird of somewhat lower elevations than either of the two preceding birds, but at the same time is not normally found at so low an elevation as that haunted by the Black-breasted Kalij. It is most numerous at 2,000 feet to 5,000 feet, but is common enough round about Darjeeling and in the interior of Sikkim up to 6,000 feet, and perhaps even higher than this in the hot weather. At 7,000 feet, however, it is only a casual wanderer, though it has been met with up to 8,000 feet. Beavan, on the other hand, found it at Pankabari at the foot of the hills (where it has been known to breed), and the natives say that in the winter it wanders into the broken land in the Tea Gardens, though the planters themselves say it is but rarely they come across one when out shooting.

Higher up amongst the Tea Gardens in the Darjeeling Terai it is still extremely abundant in many places bordering the non-cultivated areas. Here there are wide extents of land planted with tea, broken up and surrounded by ravines, steep hillsides and rugged pockets, either retaining their original virgin forest or with this replaced by a matted growth of secondary jungle even thicker than the other. These patches are a very favourite resort of the Kalij, not only on account of the protection given by their dense cover, but on account of their bordering the tea lands, which furnish good feeding grounds, and the crops of the native cultivators, of which they take due toll.

But if these places afford refuges to the birds from the encroachments of civilization, they also form, in a way, traps which lead to their destruction, for they are comparatively easy to beat, and are thus often worked by sportsmen in pursuit of them.

When the ravines and hillsides are beaten, the birds on flying out always follow two rules; firstly, they invariably make for the heaviest forest near by, and secondly, when there is a choice between two or more similar forests, they choose the one which will enable them to fly downwards.

Although I have never heard of big bags being obtained in this way, a couple of guns in a morning's beat will sometimes pick up 3 or 4 brace in addition to other odds and ends that the beaters flush.

Like all the Kalij Pheasants, it is a tremendous runner, and when worked with beaters only, will seldom rise until it reaches the very edge of the forest or bushes, when it gets up with a rush and a flurry of wings, soon getting up a considerable pace. If flying downhill, it alternately sails and flies with rapid beat of wings until it sails out of sight, drops to the gun, or descends headlong into the sanctuary of the further forest. With dogs it gets up quicker, and often perches, and if the dog distracts its attention, will then often allow the gunner to walk right up to the tree before it quits by the opposite side.

In the mornings and evenings it comes into the open to feed, both in cultivation and along the edges of roads and forest paths; in these and similar places it often affords a running shot as it scurries away on being disturbed, but it is exceptional for it to take to flight under such circumstances unless rushed by a dog.

Writing half a century ago, Gammie speaks of the Black-backed Kalij as of a shy bird, but now-a-days, it appears to be just as wild and as clever as any of its near relations in avoiding the sportsman. Gammie writes:

> " Usually it is a silent bird, but when suddenly alarmed, it " utters a sharply repeated '*koorchi koorchi koorchi*' as it rises " on the wing. When, however, the males are in the fighting " humour—which they usually are about breeding time—their " call, as they advance towards each other, '*koor koor*' '*waak* " *waak*'; the former being the threatening and the latter the " attacking note. They also at times answer each other's call " in the jungles.
>
> " In fine weather the male often makes a sharp drumming " noise by beating his wings against his sides, somewhat after " the style of the wing flapping of the domestic cock preparatory to crowing from some elevated place; but instead of the " cock's few leisurely flaps, the Kalij strikes oftener and " smarter producing a sound more like drumming than flapping. " From the same spot he repeats the noise twice or thrice at " short intervals, but gives no voice along with it. It seems " as though he was in such a joyful mood that he must give " expression to his delight somehow, but inherited experience " had effectually taught him that any attempts at crowing in " the jungle was likely to attract the attention of wild beasts, " and that he must stick to his drumming and leave the crowing part to the domestic cock, who can safely indulge in that " amusement.
>
> " The natives look on the drumming of the Kalij as a sure " sign of approaching rain. It is heard at all seasons of the " year, but most frequently before the setting in of the rainy " season; at other times generally just before a fall of rain.
>
> " The food of the Kalij is varied in the extreme. It eats " almost everything in the shape of seed, fruit and insects, but " is particularly fond of the larvæ of beetles out of cow-dung " and decayed wood, and several of the jungle yams which bear " tubers along their vines at the axils of the leaves. When the

“ vine tubers are exhausted, it will scratch away the soil to get “ at those underground.”

Gammie considers the flesh poor eating, but most sportsmen in India are pleased enough to get it for the table, especially in out-of-the-way spots where variety in food is not easily obtainable. Old cocks are, of course, tough, but young birds in the autumn are excellent eating; like all Indian Pheasants, they should be eaten as soon as possible after being killed, unless the weather is cold enough to allow of their being kept some days.

They are quite easy to keep in captivity once they have got over the first few days, during which they must be carefully watched to prevent them dashing themselves against the sides of their cage, and so killing or maiming themselves.

GENNÆUS HORSFIELDI HORSFIELDI.

The Black-breasted Kalij Pheasant.

Gallophasis horsfieldii, Gray, Gen. B. III., p. 498, Pl. CXXVI (1845).

Euplocomas horsfieldi, Blyth, Cat. Mus. As. Soc., p. 244 (1849); Hume, Str. Feath. VII, p. 429 (1878).

Euplocamus horsfieldi, Hume and Inglis, Str. Feath. V, p. 42 (1877); Hume and Marsh., Game-B. Ind. I., p. 198, Pl. (1878); Fasson, Str. Feath. IX, pp. 203-5 (1880); Hume, Str. Feath. XI, p. 303 (1888); Oates, ed., Hume's Nest and Eggs, III, p. 416 (1890).

Euplocomus cuvieri, Hume and Marsh., Game-B. Ind. I, Pl. only (1878).

Gennæus prendergasti, Oates, Jour. B. N. H. S. XVII, p. 10 (1906); Ghigi, Mem. Acad. Bologna (6), V., p. 144 (1908).

Gennæus batemani, Oates, Jour. B. N. H. S. XVII, p. 11 (1906); Ghigi, Mem. Acad. Bologna (6), V, p. 145 (1908); Harington, Jour. B. N. H. S. XX, p. 327 (1910).

Gennæus mearsi, Oates, Ann. Mag. N. H. (8), V., p. 164 (1910).

Gennæus horsfieldi, Ogilvie-Grant, Cat. Birds B. M. XXII, p. 302 (1893); id, Hand-L. Game-B. I, p. 269 (1895); Blanford, Fauna. B.I. IV, p. 92 (1898); Oates, Man. Game-B. Ind. I, p. 334 (1898); Stuart Baker, Jour. B. N. H. S. XII, p. 487 (1899); Inglis, ibid, p. 676 (1899); Oates, Ibis (1903). p. 102; id, Cat. Eggs, B.M. I, p. 55 (1901); Stuart Baker, Jour. B. N. H. S. XVII, p. 971 (1907); Ghigi, Mem. Acad. Bologna (6), V., p. 144 (1908); Harington, Jour. B. N. H. S. XIX, p. 309 (1909); Watson, ibid. XXIII, p. 582 (1915); Stuart Baker, ibid, p. 669 (1915); Stevens, ibid, p. 723 (1915).

Vernacular Names.—Mathura (*Chittagong, Tipperah, Goalpara*), Modura (*Sylhet and Cachar Plains*). Deorik, Dirrik, Durug (*Garo Hills*), Dorik (*Upper Assam*), Deodip (*Cachari*), Vohtep (*Kuki*). Inruitip (*Naga*), Yit (*Burmese*).

Description—Adult Male.—Whole head, throat, neck and body black with the exception of the feathers of the lower back, rump and upper tail-coverts. Above the plumage is glossed with deep purple blue, the purple dominating is some specimens, whilst in others the lustre is an almost pure deep blue; below, the sheen on the feathers is generally more decidedly purple than it is above.

As the edges of the feathers wear away, the sheen gradually decreases in extent, so that birds in worn abraded plumage appear to be unglossed, dull black above and very brownish below, especially on the abdomen and vent which is never very glossy.

The quills, of which only the innermost secondaries are glossed, are more brown than black, and the lustre on the secondaries is often more distinctly purple than it is on the back.

The lower back, rump and upper tail-coverts are black, subtipped with glossy blue or purple-blue, and with broad terminal bars of white.

The amount of white on these parts varies very greatly in different individuals. In the majority it consists of well-defined broad edges of white from 15″ to 25″ in depth, but in many the meeting of the black and white is broken up by a narrow strip of black and white vermiculations. In others the feathers are very highly glossed, and have very narrow white edges ; in others again these edges are so broad that the black bases are almost concealed, and the rump looks practically pure white. In a few birds the white edges to the feathers of the lower back extend also to the upper back, scapulars and the innermost secondaries and their coverts.

The lower plumage is very seldom marked with white, but I have seen specimens from Goalpara, which marks almost the extreme western range of this pheasant, from Sylhet which is the centre of their habitat, and again from the extreme East (*vide* Oates, *mearsi*) with fine white lines on the feathers of the sides of the breast and flanks, the streaks appearing either as central striæ to the feathers or, less often, on the outer webs only. I have also seen one or two specimens with faint indications of white outer edges to the breast feathers.

In young birds the central rectrices are often more or less vermiculated or narrowly barred with brown or brownish white, but this is rare in old birds.

Colours of soft parts.—Bare skin of face and lappels deep crimson, crimson or blood-crimson, brightest in the breeding season, and dullest during the moults ; occasionally this portion of the face has a rather brick-red tinge. Iris dark brown, hazel brown, or rarely, red-brown ; legs and feet dull greenish plumbeous, plumbeous, ashy-grey, greenish brown or slaty brown. Occasionally a bird may be shot with a pinkish or reddish tinge to the legs, but it is only a slight tinge of this colour, and the legs are never red as they are in the white forms of the Silver Pheasant. Hume describes one bird as having legs of " delicate pale pinkish, drabbish brown." The spur is horny brown or black, nearly always darker than the leg itself, but with a white or whitish tip. Bill light greenish or yellowish horny, the culmen darker, the base of the bill usually blackish as far as the nostrils, and sometimes beyond them.

Measurements.—Length about 24″, varying according, principally, to the length of the tail; wing from 8·3″ (210·8 mm.) to 9·5″ (241·3 mm.) and Hume gives the measurements of the wing of one his males as 10·0″ (254·0 mm.); the average of fifty birds is almost exactly 9·0″ (228·6 mm.); tarsus about 3·2″ (81·2 mm.); spur runs up to 1″ (25·4 mm.); but is usually rather under this; bill at front about 1·20″ (30·5 mm.), and from gape about 1·40″ (35·5 mm.). The crest is generally about 3″ (76·2 mm.) in a male in good plumage, but I have shot birds with crests of over 3·5″ (88·9 mm.).

The weight varies extraordinarily, birds of 4 or 5 years of age greatly exceeding the younger ones. Cocks about a year old will weigh anything between 2¼-lbs. and 2¾-lbs. but old birds often exceed 3-lbs. one such shot in November which had been feeding in the just ripened rice fields weighed no less than 3½-lbs.

Adult Female.—Above reddish brown, finely powdered with dark brown, the feathers, except of the head, edged with paler and also with pale shafts; two central pairs of feathers chestnut-brown, more or less vermiculated with dark brown, other tail feathers blackish brown, those next the central pair more or less marked with dull chestnut-brown, but still always shewing in fair contrast to them; upper tail-coverts and rump a little paler than the back. Chin and throat white, grading into brown on the foreneck; remainder of the plumage below brown, generally slightly darker than above, the shafts white and shewing up clearly against the brown webs and the edges of each feather paler than the rest; centre of abdomen paler and dingier brown; under tail-coverts blackish brown narrowly adged paler. Wing-coverts like the back, but generally more broadly edged with a paler tint; quills reddish brown, the innermost secondaries finely vermiculated with dark brown, and sometimes tipped and edged paler.

The variations in colour found in the females consist principally in the depth of colouring on both upper and lower plumage, and in the extent and colour of the pale edges to the feathers. A few birds have the upper plumage a quite dark red-brown, and the under parts are almost blackish-brown with the pale edges and light shafts very conspicuous. Both above and below the amount of pale edging varies very greatly; in some this edging is merely an ashy tint slightly paler than the rest of the feather, in others it becomes a bold sharply-defined border of almost pure white, so broad on the wing-coverts as to form two well-marked bars. There appears to be no geographical distribution governing the variations here referred to, and extremes of all may be met with in one and the same district.

The females of this and the previous species are not easy to distinguish, but on the whole *horsfieldi* is darker than *albocristatus* and has the central tail feathers a darker chestnut than either *leucomelanus*, or *melanotus*, and has the neck less greyish.

Colours of soft parts.—The colours of the soft parts seem to be much the same as in the male. The iris is usually dark brown, and not red or hazel brown, the red facial skin is somewhat less bright, and also less crimson than in the male, and there are of course no lappels.

Measurements.—Length about 20″ to 22″; wing from 8″ (203·2 mm.) to 9″ (228·6 mm.); tail from 7·5″ (190·5 mm.) to 9″ (228·6 mm.); tarsus about 2·9″ (73·2 mm.); bill at front about 1·1″ (27·9 mm.), and from gape about 1·3″ (33·0 mm.); the crest varies between 2″ (50·8 mm.) and 2·5″ (65·5 mm.).

Young Male resembles the female, but is generally much darker in colour both above and below, has the white or buff borders of the feathers in more striking contrast to the rest, and has the rectrices more mottled.

Young males assume a semi-adult plumage at the first autumn moult; the white barred rump is usually attained more or less completely, though the greater part of the rest of the plumage remains brown like the female. Others in addition to the white rump become partially, or rarely, wholly black with a tinge of blue sheen on the upper back, head, scapulars, wing-coverts and upper breast. The wing quills and tail feathers nearly always remain brownish and much mottled.

After the spring moult is completed, the cocks have usually assumed the full plumage, but even then sometimes have a brownish look about both wing quills and tail-coverts, and it is not rare to find a few brownish feathers remaining on flank, breast or back.

Chick in down.—Head rich chestnut with faint central coronal streak blackish; a streak from behind the eye very dark rich chestnut, below the streak paler chestnut and buff; median body stripe rich dark brown, sides of body and under parts ashy or ashy buff, with chestnut band across breast, ill-defined and merging into the surrounding colours. After a few days the wing feathers appear and are vermiculated reddish and brown, the bastard wing and greater coverts darker and edged with white so as to form a broad white bar across the whole wing; lesser and median coverts rich deep chestnut.

Distribution.—The Black-breasted Kalij is found over a larger area than any other of the Kalij Pheasants. It extends from the East of Bhutan throughout the whole of the Northern Districts of Assam, and from the Garo Hills on the South of the Brahmapootra throughout the Southern Districts of that Province, wandering as far East as the Western bank of Irrawaddy. To the South it is found throughout Cachar and Sylhet, South into Arrakan below latitude 20°, and as far East as the Northern Arrakan Yomas and some way down the course of the Yaw River towards Pakokku. It is also the common pheasant of Manipur, the North-West Chin Hills, in the lower portions wandering down the Chindwin as far as its junction with the Yu River, and down the Irrawaddy at least as far as Katha, or indeed (*vide* Watson in *loc. cit.*) as far as Mojok in the Ruby Mines District.

A specimen in the British Museum is labelled "Manbhum," but I do not think for a moment it was really collected in any district South of the Ganges.

The elimination of *cuvieri* has been rendered necessary, in part owing to the fact that it has latterly been proved that wherever this form is found either *horsfieldi* or *williamsi* is also found, whilst at the same time, the former has been obtained further South and further East than any of the few existing specimens of *cuvieri* have yet been taken. The other reason which has decided me in no longer recognising *cuvieri* as a true form is that there are several specimens similar in every way to this, so-called sub-species, but which shew by their irregular markings that they are merely hybrids. Finally, with further material added to that to which I could refer in 1914, I am convinced that it is quite impossible to lay down any definite area in which *only cuvieri* can be found.

Nidification.—The Black-breasted Kalij breeds throughout its area from the level of the Plains up to about 2,000 feet; above this height it is much less common, but a few nests may here and there be taken up to some 3,000 feet, whilst a few odd birds breed up to 4,000 feet and even higher. Thus I once took a nest containing 8 eggs near Hangrum, in the Cachar Hills at about 5,000 feet. Two or three times it has bred below Shillong in the Khasia Hills at about the same height, and again below Kohima in the Naga Hills at much the same elevation. In the Chin Hills, Manipur and Arrakan their eggs have been taken or the young seen at some 3,000 feet or more, but all these nests are merely those of stragglers which have been forced for some reason to breed in places well above their normal breeding points.

Most birds breed in April and May, and, owing to its not breeding over so great a range of elevation, the season is not so prolonged as is that of some of its nearest relations. At the same time I have seen nests and eggs in every month of the year from February to September, and it is quite possible that some pairs have two broods in the year. In North Cachar nests were extremely common between the 15th March and 15th May, and then for a time they were very difficult to obtain, but in July and early August many birds again started laying. The earliest nest I have known was one taken by myself at Dimagi in North Lakkimpur on the 24th February in a small patch of scrub jungle close beside a huge bheel over which we were duck shooting. Startled by the shot fired at some duck, the two birds, which were probably drinking at the edge of the water, got up with their usual flurry and fluster, and I knocked over the hen, which fell into the adjacent jungle. Going into this to fetch her out, one of the boatmen stumbled on to her nest which contained five fresh eggs.

The nest is nearly always placed in forest and the class of forest most often chosen is the damp evergreen forest met with everywhere along the foot hills and broken ground bordering the higher ranges of the Himalayas. Inside these might forests, composed of an endless variety of trees, mostly tall and mostly covered with a luxuriant motley of parasites of all kinds, but also with a plentiful undergrowth of canes, brambles and other plants, the Black-breasted Kalij has its favourite haunts. Occasionally in their inner depths one may come across tiny green glades in the general dense undergrowth. Here the vivid green moss seems even more green than elsewere, forming a springy carpet; ferns grow here and there over its surface, and the sun only comes to it in dappled, quivering patches through the branches high overhead. Such spots are much beloved by the Kalij Pheasant, and many a time have I come across its nest in the bushes immediately surrounding them. Comparatively open spots of this description attract numerous insects, and I am afraid it is these rather than their special natural beauty which induces the pheasants to commence their domestic duties within easy reach of them. The nest itself is more often than not placed in some tangle of bushes, briars or canes at the foot of one of the bigger trees, well-concealed from inquisitive friends and enemies, and in some position less moist than its surroundings. Ravines with mossy, fern-covered sides are often selected, and in such places a rock or boulder may form its principal shelter. As a work of art the nest is a failure; a heap of leaves and rubbish scratched into a heap with 'a rough depression in the middle for the eggs in the limit attained, and Mother Nature herself and not the birds is responsible for all the collecting that has been done. The great buttresses of the cotton-tree (*Bombax malabarica*), which project on all sides from the main trunk, form recesses into which the winds from every quarter blow their quota of fallen leaves and other oddments, and thus become splendid places in which birds may lay their eggs, and many a nest have I seen both of this pheasant and of other game-birds in these cosy corners.

Cane brakes, when these are not growing actually in water or marshy land, may often form the home for a brood of chicks, and occasionally the nests may be found in bamboo jungle. Such sites are, however, exceptional in Assam or Bengal, and not common in Burmah. Mixed jungle of bush and bamboo, specially when growing on a river bank, is more often resorted to, and the secondary growth which covers deserted *jhums*, or native clearings, seems to be even better liked.

Wherever the nest may be, two things seem to be essential, the very close vicinity of water and open ground not too distant for feeding. The open ground may be anything from a mere forest road to extensive cultivation, or a natural open expanse, and in the same way the water may be the river Brahmapootra itself, a lake or swamp, or it may be the mere lazy trickle of some tiny stream which wends its way from rock to rock down a hill ravine in the hot weather.

The number of eggs laid is perhaps most often 7 to 9, but very often only 5 or 6 are laid, and sometimes only 4; on the other hand this pheasant sometimes lays as many as 10, though this is probably the maximum.

In colour the eggs vary almost as much as those of the many varieties of Barn-door Fowl. I have in my collection one clutch absolutely pure white, and another a most beautiful deep pink café-au-lait, a richer, deeper colour than I have ever seen in a domestic fowl's eggs. Between these two extremes every variation may be found, but the colour of 9 eggs out of 10 is a pale buff or cream, some slightly darker, some slightly paler.

Typically the surface is quite smooth, and in some eggs there is even a slight gloss; the texture is close and hard, but though the shell is stout and strong. it is *not* coarse, but rather fine. Occasionally one comes across a clutch coarse and pitted on the surface, similar to those described by Hume, but these are the exception and not the rule. In the same way I should not say that the "usual hen's egg shape" of those described by Hume represented the average Black-breasted Pheasant's egg, though it would do for many of them. On an average their eggs are rather longer in proportion than jungle-fowl's eggs, have a nearer approach to direct reduction of size at the smaller end, and are on the whole more elegantly shaped eggs than those of that bird.

The white speckling found in some instances on most unicoloured game-birds' eggs are also to be found in these, but this is a rare occurrence, and is not often met with, as it is in the Polyplectrons and some other eggs.

In size the eggs vary in length from 1·65″ (39·9 mm.) to 2·1″ (53·3 mm.), and the average of 100 eggs is 1·92″ (48·7 mm.), and in breadth between 1·32″ (33·5 mm.) and 1·53″ (38·8 mm.), the average being 1·46″ (37·1 mm.).

Incubation seems to take 20 to 22 days in the case of all Kalij Pheasants and Jungle-Fowl, generally 20 days in the warmer, moister parts of their habitat, and up to 22 at higher, cooler elevations.

I do not think the Black-breasted Kalij is polygamous, for I have more than once come across both parents looking after a brood of young, and moreover, the male is generally to be found somewhere near the nest when the hen bird is sitting. Certainly one or more fully plumaged cocks may sometimes be found in company with several other birds in hen plumage, but these are, I believe, merely their wives and their young ones, the latter, of course, all in female plumage or in plumage which at a little distance looks like that of the female.

A very interesting little note by Mr. H. W. A. Watson in a recent number of the Journal confirms this idea that the cocks are monogamous. He writes:—

> "I came across a cock Kalij Pheasant (*G. horsfieldi*) looking "after a flock of young a few days old. I saw no signs of the "hen, though I watched the cock for several minutes. Pro-"bably she was absent looking for food. The cock was very "agressive, and ran round demonstrating, often coming within "ten feet of me. The chicks were hiding in the leaves, one "within a few inches of my foot."

According to Cripps, the hen is an extraordinarily close sitter; on one occasion he caught a female on her nest of 4 fresh eggs, and on a second occasion a hen bird sat tight on her nest whilst men were felling jungle all round her, and refused to move until the axe was laid to the tree at the root of which her nest was.

This has not been my experience, though I have seen some hundreds of nests. The hen bird nearly always sneaks quietly off before one can catch a glimpse of her; it is only when caught suddenly on the nest and unable to move without attracting attention that she will flatten herself out, almost close her eyes and try to escape notice. Even then, directly she discovers she has been seen, and before one is within grabbing distance of her, she bolts off, and on one such occasion I saw her scatter some of her eggs in all directions as she flew headlong from her nest of dead leaves and grasses.

Habits.—The Black-breasted Kalij Pheasant is a bird normally of the humid, hot climate between the Plains and some 1,500 feet elevation; in fact, just the sort of climate we should expect a black bird of this description to live in. Of course, it wanders more or less out into the plains for some fifty miles or so, and again may be found as high as 6,000 feet up in the Himalayas both North and South of the Brahmapootra. But, though the Plains' birds may be indeed often are permanent residents therein, those of the higher hills are only stragglers. I doubt if any birds permanently remain much above 3,000 feet, and only then where there are hot, sweltering valleys with dense moist forest.

In the Khasia Hills we used occasionally to find them breeding about Dumpep and the forests below the Shillong Cherrapoongi road, somewhere about 4,000 feet elevation. The birds reared here were exceptionally small and poor, and I thought at first that the Khasia Hills were inhabited by a small race of *Gennæus* *horsfieldi.* When, however, I tried to get a series together to prove or disprove this theory, it was impossible to get any but a rare straggler away from the foot hills where under 1,000 feet they were most plentiful.

Above in describing their favourite nesting haunts I have also described the kind of place in which the birds are most often to be found throughout the year. At times, especially when the bamboo jungles are seeding, they haunt this kind of cover in company with many other seed-eating birds. They also are very fond of small patches of bushes, scrub and dense secondary growth in the vicinity of villages, but they seldom are to be found in these unless there is heavy forest within easy reach.

During the early mornings and evenings they frequent forest roads and jungle paths, the edges of cultivation and the open banks of rivers and streams. Here they wander about singly, in pairs or in small flocks and family parties, often in company with jungle-fowl, with whom they consort on quite amiable terms at any other but the breeding season.

As soon as the sun is an hour or two above the horizon they gradually make their way into the forest, but continue to peck and scratch about for food until nearly midday, when they fly up into some tree to roost, generally selecting a broad limb within a few feet of the ground. They remain here until the shadows begin to lengthen, and then again descending, leisurely feed their way out once more into the open, where they stay until sunset, immediately after which they retire for the night, and are all settled on their perches long before it is dark.

They are very quiet birds as they move about in the forest, and are much less energetic and quick in their movements than are Jungle-Fowl. When they scratch and turn over the leaves in their search for grubs and fallen fruit, they do so in a very slow methodical way, and one never sees the wild scattering of leaves and misplaced fluster so often indulged in by the Jungle-Fowl of both sexes. So too they do not get stampeded by non-existent foes and rush off shrieking and cackling, only to find after a few minutes that there was no need to move at all. They go their way quietly and sedately, uttering as they move about a low *kurr-kurr-kurrchi-kurr* as if to let the other members of their family know where they are, fcr the flocks scatter a good deal when in heavy cover, until they come to the edge of the cultivation where they intend to feed. Here there is usually a halt, as each individual satisfies himself or herself there is no danger, and then out they come and commence the serious morning and evening business of getting full. Once out in the open they seem to keep closer together than in the forest, evidently relying to some extent on each other for the necessary warning in case of alarm.

They are shy birds, but yet neither so shy nor so wary as Jungle-Fowl, and when the two are together it is almost invariably the Jungle-Fowl who first takes alarm and sneak off into safety. Their manner too of leaving is very different. A cock Jungle-Fowl disturbed takes but a second to make up his mind, a rapid glance in the direction of the intruder, and down go head and tail, and with hasty but stealthy steps he is off out of sight. The Pheasant is not nearly so prompt in his actions, and if one disturbs a party of these birds and keeps absolutely still, quite an amusing little comedy may be seen before they make up their minds that discretion is the better part of valour. When standing in the deep shade of a tree I have seen from a distance of some 40 or 50 yards a party of Kalij Pheasants take minutes to decide if I was dangerous or not. An unlucky twig stepped on as I crept along just inside the jungle had attracted their attention, but the light was bad, and the food on which they were engaged,—termites—plentiful and engrossing. At the snap of the twig every bird stopped and looked at me, for the first instant motionless, and then, screwing and twisting their necks about in an endeavour to get a better view. After a few seconds a fat white ant tumbling down in front of one bird was more than she could resist, and a hasty snatch and gulp put it safely away. No harm coming to her from this, she was very shortly busily re-engaged in chasing and gobbling up the termites as they crept from their holes or fell down again after their flight. Her example was enough for the others, and within five minutes they were all happily engaged as unsuspecting as if no danger was anywhere near them.

It was so amusing to watch them, that I cautiously stepped back into still darker shadow without frightening them. A patch of ground on which hill-rice had been grown and cut had left as stubble some 4 to 6 inches high, and amongst this the Pheasants, 8 in number, scurried to and fro, darting at ant after ant, often fluttering up a few feet in the air as if in ungainly amulation of the kingcrows, jays, and other birds which constantly swept backwards and forwards in graceful pursuit of those insects which had winged their way higher up.

Ten minutes of this, however, satisfied my curiosity, and as I was in camp, and had to shoot for the pot, I then stepped out, bowled over the cock as he ran helter skelter for the bushes, and his wife, as she winged her way over his fallen body.

The Kalij nowhere collects in such numbers as to afford a day's sport like the Jungle-Fowl does yet there are many places where with a few beaters one may get quite enough shots to make a very interesting morning or evening's walk, and probably with dogs—personally I have never shot with trained ones—the result might be even better.

As far as I remember six brace of Kalij Pheasant is the biggest bag I have ever made of these birds and this was made over practically the same ground as that which is described in the article on Jungle-Fowl shooting in the last number of the Journal.

As a rule, when shooting along these mustard fields bordering the Kopili River one got two or three Jungle-Fowl to one Pheasant, but this time the reverse was the case.

My companions (on the occasion of which I write) consisted of a Mikir tracker, and a second Mikir with my rifle, and an odd man to work as beater, jungle cutter, luncheon carrier, &c. This was quite enough for all the beating we should require, for the strips were mostly narrow bits along the banks, shut in on one side by very heavy evergreen forest, and on the other by the shingly banks of the stream. Starting just after daybreak, our first "*jhum*," or open bit of cultivation, was occupied only by some Jungle-Fowl who were the first to detect our meeting, and gave no chance of a shot, but as we passed through the next bit of forest, a hasty but lucky shot right and left brought down two fat Bronzed-backed Imperial Pigeon, and some quarter of a mile further on we came to a second mustard field. In this we could see some birds feeding about half-way down, though we could not make out exactly what they were in the tall mustard. Leaving my men under cover, I went forward inside the jungle about 20 yards, and when I judged I had gone far enough, notified them with a low whistle to come on. Sneaking along just inside the frings of forest I kept about the same distance, or a little more ahead of the men, and when frightened by the latter, the pheasant got up, had an easy right and left, adding two more birds to the bag. My next shot was at a hen Jungle-Fowl, as she scurried through the mustard into shelter, just giving me a momentary glance as she left the former. Picking her up, we then went on through a patch of semi-burnt cane and grass, missing an old cock Jungle-Fowl as he got up with a cackle and tremendous flurry on the far side of some charred canes.

Two more long snap-shots at running birds are tinkered, and then I have a bit of luck, for we step out of the jungle into a mustard field, right into a family party of Kalij, who are scratching round for food just outside the forest. Quite overcome by the suddenness of our appearance, the birds, 6 in number, take at once to flight, scattering in all directions, but two drop to my shots, and two others who have gone towards the stream are turned back by the sight of some men fishing, and wheel round to their original cover, giving me splendid high overhead shots, and both coming down tremendous thumps in response thereto. One of these, however, is a runner, and for some time evades my men in their efforts to catch her, until at last a luckily flung stick bowls her over as she dodges from one bush to another.

So we wander on, now through a bit of virgin forest, now through a mustard field, and then through a piece of burnt grass, the black surface shewing the pugs of a tiger who has passed by some two or three hours earlier. We follow them to the stream where the tiger has had his drink, and then return to the forest in which we soon lose all trace of him.

Changing my rifle once more for the smooth bore and leaving stripes to rest in comfort, we turned and worked down the opposite side of the stream towards camp. The first birds we put up are some Jungle-Fowl who have been drinking before retiring into the forest for their midday siesta; as they fly past us I knock the tail feathers out of the cock bird leading them, with a real bad shot, and bring down a second with a straighter one. The tailless cock and the others have gone down in the jungle just ahead of us, so spreading out, we walk them out toward the next *jhum* every now and then hearing them as they hurry forward, rustling over the fallen leaves. Before we get to the edge of the jungle, they have cleared off without giving another chance, but a single cock Kalij which has tarried a little longer than the others gets up just as we too emerge from the trees, and is promptly bowled over and gathered. The mustard here is so high, up to our waists, that we may find some birds lying up in it, and accordingly we work through it in line, myself on the inside next the forest, and a few yards ahead of the men. Within the next few minutes two birds run through the mustard and gain the jungle in front of me without giving a chance, and then a barking deer jumps up and comes bounding past me about 40 yards off, barking as he starts, and barking again as he gains cover and stands, inside defying me. He is still barking as we pass where he stands and I can hear the stamp of his forefeet before panic again seizes him, and he dashes away further into the depth of the forest. Nothing more shews up until I have reached the end of the mustard, and stand on the yard or two of bare ground which separates it from the nearest trees. As the men come nearer, two or three Jungle-Fowl flit across it, and then there is a tremendous commotion as nearly a dozen birds, Jungle-Fowl and Pheasants mixed together rise into the air. A hasty shot at one of the former, not only knocks it over, but also accounts for an unlucky hen pheasant which has come into the line of fire, and a second shot brings to bag another hen pheasant which falls, a cloud of flying feathers, with a bang right on to the man with my luncheon basket. After he has righted himself and collected my scattered provisions, we proceed on our way, and by noon, when we stop to have a rest and lunch, I have managed to bag twelve Pheasants, six Jungle-Fowl, three Imperial Pigeon, and a couple of very evil-smelling White-eyed Pochard, which, however, are not disdained by the coolies.

Kalij Pheasant are not nearly such noisy birds as are Jungle-Fowl, but call—one can hardly call it crowing—pretty regularly during the breeding season. This call or crow seems to be uttered only during the mornings and evenings, and never in the middle of the day, as is that of the Jungle Cock. A Cock Kalij only calls on his roosting perch before he gets down from it in the morning, and after he has returned to it in the evening before settling down for the night. Nor does he use his crow as a challenge to other cocks; when he wants a fight, or pretends that he wants a fight, he proclaims the fact by loud flappings of his wings, and by quickly repeated beatings together of the tail above his back, and also by beating them on his ribs. In the former case the sound made is very loud and sharp, only lasting a second or two, but when a male bird drums against his side the noise is much lower and softer, and is continued for some seconds or even minutes.

At the same time the Kalij is not in the same class as the Jungle Fowl as a fighter in any way, far slower and less decisive in his movements, he has not the same real delight in a scrap as has that bird. I have often heard Kalij Cocks defying one another to mortal combat when seated at a few yards apart, but the finale has nearly always been disappointing. If one bird really makes up his mind to fight, the other has as a rule already made up his mind that he does not want to. Sometimes they will actually meet, and after much mutual abuse and wary walking round, both birds simultaneously decide that there is really nothing to fight about, and retire to their own domains, or commence feeding.

Now and then in the height of the breeding season the fights develop in to really fierce battles, and are continued until one or the other of the combatants owns himself beaten and sneaks away, often in a very tattered and featherless condition about head and neck.

I have already described a fight which I witnessed between a cock Jungle-Fowl and a Kalij Pheasant, but in this case the former was the aggressor and the latter would have retired after a very few rounds had he been able to escape.

A similar fight, though on this occasion the *casus belli* was in possession of an ant-hill from which termites were issuing, was witnessed by Mr. R. A. Clark in Cachar. In this instance also the fight ended in the running of the Kalij. After a description of this fight, Mr. Clark writes:—

> "On another occasion I came across a pair of male Kalij "fighting amongst a lot of fern; they were so taken up with "their own affairs that they did not notice my having "approached to within fifteen yards; I let them go on for ten "minutes, and then went up and caught both; they were "quite exhausted, the feathers from the head and neck had all "been knocked off, and the latter were bleeding in both birds."

Like the rest of the family in India, these Pheasants prefer to use their legs to their wings to avoid pursuit, and will always run rather than fly as long as there is any cover to conceal them, and no obnoxious dog to put them up. Unless they are actually forced to the very edge of a jungle by beaters or one comes on them in the open so suddenly that they lose their heads, it is most difficult to make them rise, and when shooting, more especially when shooting for the pot, it is frequently necessary to shoot them as they run, perhaps no easier a feat than when they are on the wing, for they make use of every scrap of cover, and only give the snappiest of snap-shots as they dodge from one bush to another.

On the wing they are fair fliers once they get away, though they appear to be going much slower than is really the case. On the flat they simply fly from one forest to another, but when shooting in hills the sportsmen will find they nearly always run *up* hill and fly *down* hill, consequently after the first mad rush into the air they sail down at a tremendous pace, and one must keep well forward to obtain clean shots. They do not stand, comparatively, as much knocking about as do Jungle-Fowl, though they are bigger and heavier birds; they have not as much heart, and their feathers seem to be less impervious to shot than those of that bird.

They are very omnivorous in their diet and will eat practically anything from bamboo seeds to small snakes and lizards. Their favourite articles of food are the same as those of all other game-birds, with whose habits I am intimately acquainted, *i.e.*, white ants, fruit of the various *fici* and bamboo seed. To this must be added, in the case of the Kalij, forest yams and the roots of small ginger-like plants very common over a great portion of their habitat.

Birds which have been feeding on this extremely acrid, pungent root are almost uneatable, otherwise they are normally very good eating, though naturally old birds are tough unless eaten whilst still warm or hung for several days. Probably the best way of eating these birds is in the old gipsy manner, rolling them up in a mass of clay, feathers and all, chucking them into a heap of red-hot ashes until the clay is baked hard, after which the clay may be broken, when the feathers come away with it, and the dish is ready.

Like the Jungle-Fowl, the Kalij Pheasant is difficult to domesticate, but by no means impossible, and given a big enough aviary and lots of brushwood or other cover under which to hide, they soon become more or less tame. It would probably be impossible to tame them sufficiently to run loose with domestic fowls, for though chicks may be hatched from eggs put under hens and reared without much trouble, they always clear off directly the breeding season approaches.

Cripps says that they are quite impossible to tame, and that he has seen many in Sylhet as wild to the last as the day they were caught. It must be remembered, however, that the Sylhetees and other people of the Assam Valley who trap these birds in great numbers keep them in tiny cages, and make no real attempt to domesticate or tame them. As a matter of fact these people actually sew the poor birds' eyelids together as soon as they are caught, in order to prevent them knocking themselves to pieces in the cages. When thus blinded, the birds crouch in one corner and refuse to move, and even if released from the cage, make no attempt to escape. I have sometimes bought some of these birds in order to release them from this cruelty, but I must say that they seem to suffer less from the eyelids being fastened than from the self-inflicted injuries once the eyelids were freed of the stitches. The Hill-Tribes catch these pheasants in many ways. The small brushwood fence with well-noosed little gaps at intervals has often been described as that used for other birds; another plan is to noose the sides of a path on which grain has been thrown, and yet another means employed with success is to peg down a decoy bird, surround it on all sides with nooses and then secure any bird which comes either to fight with or examine the decoy. I should mention that I have never known a decoy bird either drum, crow, or in any other way *challenge* his wild rivals to a fight, at the same time his fluttering attempts to regain his freedom accompanied by indignant squawks and squeaks as the string checks his efforts seem equally effective in attracting notice.

GENNÆUS HORSFIELDI WILLIAMSI.

Williams' Kalij Pheasant.

Gennaœus williamsi, Oates, Man. Game-B. I., p. 342 (1898); id, Ibis. 1903, p. 104; id. Jour. B.N.H.S. XVI., p. 86 (1907); Ghigi, Mem. Acad, Bologna (6), v., p. 142 (1908).

Gennœus turneri, Finn., Jour. Asiat. Soc. Beng. XIX., pt. 2, p. 146 (1901.)
Gennaœus macdonaldi, Oates, Jour. B.N.H.S. XVII., p. 10 (1906); Ghigi, Mem. Acad. Bologna, (6), v., p. 142 (1908).
Gennœus ommaneyi, Oates ?. Type in B.M.

Vernacular Names.—Yit (*Burmese*), Rak (*Arrakan*).

Description.—Adult Male.—Crest black; head, neck, back and wing-coverts grey, this effect in colour being formed by numerous tiny bars of white or buffy white on a black ground; feathers of lower back, rump and upper tail-coverts black, crossed with several narrow bars of white, and with broad white edges, these edges being sufficiently bold to make these portions of the plumage contrast strongly with the tail and upper back. Tail like the back, but more boldly marked with bars rather than with vermiculations.

Visible portions of the wing quills like their coverts, inner webs of primaries brown, obsoletely mottled with darker brown, whole lower plumage black, like all other sub-species inhabiting a range of country between two species, this form varies considerably on the outer limits of its habitat. The variation consists principally in the boldness of the markings which make up between them the grey of the upper parts; in some specimens the markings are so minute that they can only be called vermiculations, though these seem to always run in regular bars, in others the markings are bolder and form distinct bars of white on a black ground. These latter individuals become more and more common as we approach the limits of *rufipes*, whilst the former characters predominate as we draw nearer the country occupied by *oatesi*. In this part of the southern region covered by *williamsi*, it is also noticeable that the rump and upper back grade into one another through the lower back instead of the upper back being sharply defined from the other two. Such specimens are, however, comparatively rare, and even in these the rump and upper tail-coverts are quite boldly barred with white in comparison with the rest of the plumage.

Colours of the soft parts.—Iris brown, light brown or golden brown; lappets and facial skin deep crimson red or crimson, duller in the autumn and winter; legs various shades of dark and light plumbeous-brown, ashy-brown, or fleshy livid, never red; the spur is a dark horny brown with a paler tip.

Measurements.—Wing from 8·6″ (218·4 mm.) to 10″ (254·0 mm.); average of forty birds, 8·91″ (226·3 mm.); tail from 8·6″ (218·4 mm.) to 12″ (304·8 mm.); average of forty birds, 10·15″ (258·8 mm.); tarsus about 3″ (76·2 mm.), with a spur up to 1″ (25·4 mm.); but generally about ·7″ (17·8 mm.); bill at front 1·2″ (30·4 mm.), and from gape 1·4″ (35·6 mm.).

The crest runs up to about 3″ (76·2 mm.), but is generally about 2·5″ (69·5 mm.).

Adult Female.—Very similar to true *horsfieldi*, but can always be distinguished by the tail feathers. In this sub-species the central or two central pairs are much the same as in the other sub-species, though they are generally paler and still more chestnut in colour, the outer feathers are, however, black or nearly black with numerous narrow and irregular broken bars of white. On the whole the females of *G. h. williamsi* are paler and more chestnut on the upper plumage, but this does not always hold good, and over every portion of its area, specimens of *williamsi* may be met with quite as dark as the the darkest of *G. h. horsfieldi*.

The females of this sub-species appear to be remarkably constant, for though the British Museum has an excellent series, little variation can be found in it. A few birds are decidedly paler than others, and have the general tone more a buff than a chestnut. The under surface of the tail varies from an almost unmarked blackish brown to a well-barred surface similar to the upper aspect.

Colours of the soft parts.—Similar to those of *horsfieldi*. It should be noted particularly that the legs of this sub-species, both male and female, are those of true *horsfieldi*, and shew no signs of grading into the red legs of *rufipes* and the *nycthemerus* group.

Measurements.—Wing from 7·7″ (195·6 mm.) to 9·1″ (231·1 mm.) average of thirty birds, 8·35″ (212·1 mm.); tail from 7·2″ (183·9 mm.) to 8·8″ (233·5 mm.); average of thirty birds, 8·06″ (204·7); tarsus about 2·75″ (69·8 mm.); bill at front about 1·1″ (27·9 mm.), and from gape a little over 1·3″ (33·0 mm.).

Young Male.—A specimen in the Oates' Collection which is labelled "♂, see spurs" is identically like an adult female. In spite of the spurs, on account of which this specimen has been sexed ♂, I should not be surprised if it turned out to be an old barren female. One would expect young adult males carrying spurs like this to be in male plumage, and we should also expect the young males to follow the same rules as *horsfieldi* and be considerably darker and more boldly marked below than the females.

Distribution.—Williams' Silver Pheasant has a very well defined range, being practically confined to the moderately high hills lying between the Manipur, Yaw, Oyu and Irrawaddy Rivers, and in the Arrakan Yomas on the East, and the hilly country East again of the main ridge as far South as Minbu on the Irrawaddy and further West as far as latitude 19·5, or about level with Thayetmyo. North it occurs as far as Homalin and Tammu, whence I have seen typical specimens. In Arrakan, South of Pakkoku, it appears to be rare, and over much of the low-lying dry zone, no Silver Pheasants are to be found. To the West it is found on all the higher ground on the East of the Manipur River, typical specimens having been obtained from Fort White, Tiddim, Falam, &c.

On the rivers themselves and at levels below 1,000 feet true *horsfieldi* penetrates far into the areas, the higher parts of which are occupied by *williamsi*, and the consequence is that on the intervening line we are constantly meeting with birds which cannot be ascribed to either sub-species, and again other birds which appear to be the result of interbreeding between *horsfieldi* and *rufipes* or even *horsfieldi* and *nycthemerus*.

In the Southern low-lying portion of the inter Chindwin-Mu and Mu-Irrawaddy regions there appear to be no Pheasants except for a rare straggler of true *horsfieldi* which may now and then be met with in the forests bordering the rivers.

Nidification.—So far there is nothing on record as regards the nidification of this sub-species, though its nests and eggs have been taken by Messrs. P. Wickham, J. M. D. Mackenzie and C. Hopwood, and also, I believe, Mr. P. MacDonald.

Nests with eggs have so far apparently only been taken in April and May, but there is little doubt that though these two months are probably those in which most eggs are laid, they will also be found in March and June, and probably other months as well.

Judging from what my correspondents write, their nests appear to be the same as those of the rest of the family, a mere heap of leaves in bush jungle or forest, or, sometimes, in bamboo jungle. The number of eggs laid is probably about 6 to 8, sometimes less, but seldom more, and they are similar to those of *horsfieldi*, but would appear to average smaller. Eggs I owe to Messrs. Hopwood, Wickham and Mackenzie, range in length from 43·6 mm. to 47·7 mm. and in breadth from 33·6 mm. to 36·8 mm., whilst they average 45·5 mm. by 35·8 mm. The few I have seen have all been of a pale buff or cream colour, but doubtless they vary in depth of tint much as do all Kalij Pheasants' eggs.

Habits.—Williams' Kalij Pheasant seems to be a bird of moderate levels, never descending to the Plains except as a casual wanderer down to the smallest trees, and seldom being found above 4,000 feet, though in some isolated peaks such as Mount Victoria, it has been shot as high up as 6,000 feet.

There is practically nothing on record as to its habits, but what little there is shews it to be the same shy, skulking bird as the rest of the genus, using its feet always in preference to its wings, and almost impossible to flush without the use of dogs.

Its plumage of grey makes it quite as difficult to see in the semi-shadow land of the places it haunts, as is the more sombre black plumage of the Black-breasted Kalij in the deeper shadows of the ever green forests found in the wetter valleys below. Col. Harington informed me that he had never come across this pheasant in the hot dry zone in the South of the tract between the Irrawaddy and the other rivers on the West. He also told me that he believed it to be a very rare bird throughout the Pakkoku District, which was too hot, too low and too dry for it, and probably it would not occur, except accidentally, away from the hill ranges which run down from the Central Arrakan Yomas. It was, he said, essentially a bird of the forest or mixed forest and bamboos, and did not haunt the higher grass-covered plateaus which are often frequented by the birds of the *nycthemerus* group.

(*To be continued.*)

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY

No. XVI.

(A)—THE TUPAIAS OF SOUTH TENASSERIM.

BY OLDFIELD THOMAS.

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A nice series of Tree Shrews from Pegu, topotypes of *Tupaia belangeri*, presented by Mr. J. M. D. Mackenzie, has enabled me to investigate afresh the relationship of the southern members of the *T. belangeri* group to the northern members of the *ferruginea* group.

When Dr. Lyon wrote his Monograph of the Tupaiidæ in 1913 the only modern examples of typical *belangeri* were two collected near Rangoon by Major Harington, and these differ materially in their degree of rufous on the posterior back, the one almost without it, the other strongly rufous.

Having to choose one of these as the more typical, Dr. Lyon chose the rufous one, but Mr. Mackenzie's series now shows that the normal coloration in this region is as in the other specimen, without rufous on the rump.

Further east in the Moulmein region, and southwards as far as Tenasserim town, similar forms occur, but becoming more and more frequently rufous or ochraceous posteriorly.

All these animals have a short snout to the skull, and have three pairs of mammæ. evenly spaced on the axillo-inguinal area.

In the extreme south of Tenasserim, however, at Bankachon (spelt by Davison Bankasun) the local form is much brighter and more markedly red-rumped, and this seemed at first to indicate a local sub-species of *belangeri*. Specimens of it collected by Davison have long been known, and always considered as *belangeri*.

But close examination shows the remarkable fact that while these specimens have the general appearance, and (with the variation indicated below) the mammary formula of *belangeri*, they have the longer skull of the North Malay representative of the *ferruginea* group, *T. lacernata wilkinsoni*, whose type locality is Trang, about 180 miles south of Bankachon.

This skull difference—and there is no other—seems slight when isolated specimens are examined, but is so constant and with such a complete absence of intermediate specimens that there seems no doubt that the *Tupaia* of extreme S. Tenasserim is a distinct species intercalated between *belangeri* to the north and *lacernata* to the south.

It may be briefly described as follows:—

Tupaia clarissa, sp. n.

Colour essentially as in *T. belangeri* but brighter and clearer, and the rump more definitely ochraceous, contrasting with the clear olive grey of the fore-back and head. Mammæ in three females 4, 5 and 6, their positions, when 6, as in *belangeri*, and, when less than 6, such as to indicate that it is the normal posterior pair which is absent, the spacing being quite different from that found in the four-mammied *lacernata*.

Skull with the narrow elongated muzzle of *lacernata*, its length, measured from the gnathion to the concavity on the front edge of the orbit above the lachrymal projection, 24, 24, 24·1, 24·4, 24·6, 24·6, 25·2 in seven specimens, as contrasted with 22·0, 22·1, 22·3, 22·3, 22·4, 22·6, and 23·3 in an equal number of *T. belangeri* from the region of Tenasserim town.

Dimensions of the type, measured in the flesh :—

Head and Body :—182mm. ; tail 171 ; hindfoot 43 ; ear 17.

Skull :—Greatest length 52·5 ; condylo-basal length 49·5 ; length of muzzle 25·2 ; upper tooth row 28·5.

Hab :—Bankachon, Victoria Province, S. Tenasserim.

Type.—Adult male. B. M. No. 14.12.8.95. Original number 4395. Collected 5th December 1913 by G. C. Shortridge. Presented to the National Museum by the Bombay Natural History Society.

T. clarissa cannot have a very wide distribution, as it is replaced by *T. belangeri* 120 miles north at Tenasserim town, and by *T. wilkinsoni* 180 miles south at Trang. It probably ranges along the hills which extend for about a hundred miles south of its type locality Bankachon.

These very clear-coloured red-rumped specimens being completely removed as a separate species, we may further consider whether the southern form of *belangeri*, as best represented by the Tenasserim series, can still be looked upon as quite the same as the typical race of that species as found in Pegu.

Of the available specimens from Pegu, now 10 in number, only one, No. 6.4.5.3, referred to by Dr. Lyon, has a rufous hind back, and this may possibly be due to bleaching. And the type in Paris, as recorded by Dr. Lyon, is also without rufous. On the other hand, of seven examples from Tenasserim town and its neighbourhood all but one have a well marked rufous or ochraceous rump, and this is also the case with most Mergui specimens and a considerable proportion of those from Northern Tenasserim up to the mouth of the Salween.

Consequently we might well recognize the average difference in colour between the extremes by making a local subspecies of the form from Tenasserim town and its neighbourhood, and looking upon the Moulmein and other North Tenasserim specimens as intermediates.

Tupaia belangeri tenaster, subsp. n.

Colour as in true *belangeri*, but the rump more or less ochraceous. Mammæ 6. Proportions of snout as in *belangeri*, not as in *clarissa.*

Dimensions of the type—

Hind foot:—40·5.

Skull:—Greatest length 50; condylo-basal length 46·8; length of snout 22·3; upper tooth series 26.

Hab.:—Of type, Tagoot, Great Tenasserim River; other specimens from Tenasserim town.

Type.—Adult male. B. M. No. 17.3.25.3. Original number 5153. Collected 18th April 1914 by G. C. Shortridge. Presented to the National Museum by the Bombay Natural History Society.

(*B*)—NOTES ON MILLARDIA AND ITS ALLIES.

BY OLDFIELD THOMAS.

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In attempting to determine a Mettad sent to the British Museum by Col. H. N. Dunn from Ambala, I have examined all the available specimens of the group, quite a considerable number, and mostly part of the Indian Mammal Survey material.

With regard to the relations of the very distinct Burma species, *Millardia kathleenæ*, to the typical Indian Mettads, with which I doubtfully associated it, I now find that like as its skull is to that of a true *Millardia*, the structure of its teeth is not the same, so that in conjunction with its mammary formula, it may well be distinguished generically.

Remembering its discovery by Mr. Guy C. Shortridge, who believed, and as it now proves rightly, that he had found a new genus, I would propose for it the name of

GUYIA, g. n.

General characters, number of foot-pads and structure of skull as in *Millardia*, but the mammæ 0-2=4 instead of 2-2=8, and the molar pattern different.

Genotype *Guyia kathleenæ* (*Millardia kathleenæ*, Thos.).

Range:—Dry zone of Burma. As yet only known from Mt. Popa and Pyawbwe.

The most marked characteristic of the molars of *Millardia* is their considerable breadth as compared with their length, and the subequal and very distinct development of each of their cusps, so as to give them a superficial resemblance to those of *Golunda*. On the other hand in *Guyia* the teeth are not broader than those of normal Murines, and the peculiar look of those of *Millardia* is quite removed by this fact and also by the almost complete obsolescence of the outer cusp of the first lamina of m^1 (*t* 3 of Miller's notation *), and the reduction, relative and absolute, of the corresponding cusp in the second molar. The last lamina of m^3 also consists of only one instead of two cusps, but enough young specimens are not available to determine how far this difference is constant.

Passing to true *Millardia*, we find that there is so wide a range of variation, in series from single localities, in general size, size of skull, and especially in the size of the teeth, that it seems impossible to sort them into species by these characters, and we are reduced to distinguish them by colour only.

Judged by this alone there seem to be four recognisable forms of the genus, two of a normal greyish colour, respectively lighter and darker, and two of a pallid or desert colour. All four, in the absence of more essential characters, I should only consider as local subspecies.

1. *Millardia meltada meltada*, Gray, from the following regions, *viz.*:—Dharwar, Ahmednagar, Hoshangabad, Hazaribagh†, Coorg and Ceylon. Greyish mouse colour, commonly bleaching to brown.

2. *Millardia m. listoni*, Wr., from the Konkan and Nasik; darker grey.

3. *Millardia m. pallidior*, Ryley., Gujerath, Kathiawar, Cutch and Sind; pallid grey.

And finally the following new form:—

4. *Millardia meltada dunni*, subsp. n.

Size of type small. General colour above pale whitish buffy, lined with the dark brown tips of the longer hairs, the light rings pale buffy. Flanks clear light buffy. Undersurface white with scarcely a tinge of buffy, the basal two-thirds of the hair slaty as usual. Ears pale brown. Hands and feet white, tail rather short, well haired, dark brown above, white on sides and below.

Skull with the supraorbital crests not heavy, though the specimen is old. Palatal foramina to the level of the anterior inner root of m^1.

Dimensions of the type.—Head and body 114 mm; tail 94; hindfoot 22·5; ear 21.

Skull.—Greatest length 31·5; condylo-incisive length 30·5; zygomatic breadth 15; nasals 12·7; palatal foramina 7·5; upper molar series 5.

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* Mamm. W. Europe, p. 801, 1912.

† But with regard to this locality, by far the most eastward of all, see below under *Diomys crumpi*.

Habitat.—Amballa, Punjab. Type from Handiserah.

Type.—Old male. B. M. No. 8.3.3.5. Original number 229. Collected 6th December 1907, and presented by Col. H. N. Dunn, R.A.M.C.

This subspecies differs from its near ally *M. m. pallidior* by its more buffy coloration and shorter tail.

(*C*)—A NEW GENUS OF MURIDÆ.

BY OLDFIELD THOMAS.

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In the previous note mention was made of Hazaribagh as a locality for *Millardia meltada meltada*, a record resting on a specimen (Collector's number 5127; B. M. No. 15.4.3.135), obtained by Mr. Crump on Mt. Paresnath, at an altitude of 4,300′.

The specimen was determined as a Mettad by Mr. Wroughton, and was catalogued as such in his Report No. 19, on the Behar Orissa collection.

So far as the skin is concerned I cannot believe this determination to be incorrect. Not only does the skin agree absolutely in colour and proportions with typical *meltada*, but its foot-pads and mammæ are both as in that species.

But the skull assigned to it is obviously entirely different from that of *Millardia*, and since the identity of the skin with *Millardia* seems too complete to be due merely to accidental resemblance I suppose the skull not to belong to it, and to need separate determination.

Such determination however I quite fail to make, and now consider the skull to represent a new genus, which may be called

DIOMYS, g. n.

External characters unknown (or, if I am wrong in the above supposition, absolutely as in *Millardia*).

Skull lightly built, its anterior part long, low and narrow, the muzzle and nasals particularly long and narrow. Nasals abbreviated anteriorly so that the incisors and the front part of the nasal chamber are visible in front of them from above. Interorbital region of normal shape, the supraorbital ridges well developed, but not excessively so. Zygomatic plate long horizontally, well projected forwards, its anterior edge vertical. Anterior palatal foramina very long, reaching well between the molars, well open, their sides parallel. Posterior palatal foramina small. Mesopterygoid fossa parallel-sided, well open, as in *Rattus* and its allies, its breadth anteriorly nearly double that of the narrow part of the base of the pterygoids bounding it on each side. Bullæ not preserved in the only specimen available.

Upper incisors light and slender, more thrown forward than usual, their angle to the tooth row about 88°; their outer edge rounded, their front surface unusually roughened, their cutting edge slightly notched. Lower incisors very long, projecting more out of the bone than in any of the allied genera. Upper molars with the relative proportions of those of ***Rattus***, and their structure on the whole more as in the Rats than in the *Mus-Leggadilla* series of genera. But the outer cusp of the anterior lamina of m^1 (*t* 3 of Miller) is completely absent, while there is a continuity between the two inner cusps (*t* 1 and 4), with the second and third median cusps (*t* 5 and 8) which appears to have developed earlier than the state of wear of the teeth would lead us to expect. In the second molar, the antero-internal cusp (*t* 1) is further back than usual, its front edge behind the level of the main median cusp (*t* 5) with which it is already in direct continuity by wear; the inner walls of this *t* 1 and the cusp behind it (*t* 4) very high and sharp edged. M^3 apparently of normal structure.

DIOMYS CRUMPI, sp. n.

Skull and teeth as above described.

Dimensions of type.—Gnathion to back of interparietal, 32·5; tip of nasals to back of interparietal, 31·3; front of incisors to basilar suture, 25·6; zygomatic breadth, 16·2; nasals, 11·8 × 3; interorbital breadth, 4·7; breadth between ridges on brain case, 12; zygomatic plate, 4; palatilar length, 16·5; palatal foramina, 8·5 × 2·5; anterior width of posterior nares, 2·2; upper molar series, 5·4; length of m^1 2·6.

Habitat.—Pareshnath, Hazaribagh, Behar.

Type.—Skull only. B. M. No. 15.4.3.164. Collected by C. A. Crump. Presented to the National Museum by the Bombay Natural History Society.

Named in honour of Mr. C. A. Crump, its discoverer, whose effective collecting work in various localities has so greatly assisted the Survey.

The true affinities of this animal are by no means easy to determine. While the general look of the skull, its slender build, long narrow muzzle and notched incisor-tips suggest the *Mus-Leggadilla* series of *Muridæ*, its molars, both in structure and proportions, and its well open posterior nares, are more as in *Rattus*, although no species of that genus can be found with teeth of absolutely similar structure. Perhaps *Rattus berdmorei* and *manipulus*, with their forwardly directed incisors, may represent a commencement of an approach towards it, but the approach is certainly not near enough to give rise to any doubt as to the generic distinction of the new form.

I trust it may not be long before specimens showing the external characters of this interesting animal may be obtained, while further skulls, of various ages, will help to illustrate the detailed structure of its molars, now only known from a single well worn specimen.

Postscript:—Since the above was written Mr. Crump has seen the specimens and had the difficulty about their origin explained to him. He remembers obtaining a single rat among the rocks at the top of Mt. Pareshnath, and while not venturing to express absolute certainty, he is still inclined to believe that the skin 15.4.3.35., like as it is to that of a Mettad, really belongs to the skull, so obviously that of a very different animal. Further material can alone solve the problem, but a rocky mountain top does not sound the natural place for an animal with its posterior foot-pads aborted, as in the plain-loving *Millardia*, and so many other plain and desert mammals.

(*D*)—THE SPINY-MOUSE OF SIND.

BY OLDFIELD THOMAS.

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In his Mammals of India Mr. Blanford records a Spiny-mouse from Sind as *Acomys dimidiatus*, and the specimen he refers to still remaining unique so far as India is concerned, that determination has not hitherto been re-investigated, in spite of the great distance between Sind and the Sinaitic Peninsula, the type locality of *A. dimidiatus*.

Now however, at Mr. Wroughton's request, I have carefully examined this specimen, and find, as is not surprising, that it cannot be referred to *A. dimidiatus* and apparently needs description as new.

Acomys flavidus, sp. n.

Allied to *A. dimidiatus*, but colour paler, and no line of demarcation present on sides.

Relative development of fur and spines about as in *dimidiatus*, the spines not extending forward to the head, as is the case in *russatus*. General colour above very pale yellowish sandy, about as in *A. russatus ægyptiacus*, decidedly paler than in *dimidiatus*. This colour gradually lightens on the sides, without sharp line of demarcation, to yellowish white, the whole of the undersurface and the feet being of the latter colour. Tail longer than head and body, wholly white above and below.

Skull like that of *dimidiatus* in its general proportions, and the development of the cranial ridges.

Dimensions of the type, measured on the spirit specimen:—

Head and body 90 mm.; tail 101; hind foot 19·5.

Skull, greatest length 30·6; condylo-incisive length, 27·5; zygomatic breadth 14·7; nasals 11·4; interorbital breadth 4·8;

breadth across braincase between ridges 13; palatilar length 14·6; palatal foramina 7; upper molar series 4·5.

Hab.—Laki Hills, Sehwan, Sind.

Type.—Adult male in spirit. B. M. No. 91. 11. 1. 11. Collected by Mr. H. E. Watson and presented by Mr. W. T. Blanford.

This species has considerable superficial resemblance to *A. russatus*, especially to the Egyptian form of that animal, but has not its greater extension of the spines anteriorly, its heavily clad ears or black soles. No doubt it is really a pale eastern relative of *A. dimidiatus*, from which it may be distinguished by its greater pallor and the complete absence of any sharp line of separation between the yellowish of the upper surface and the white of the lower.

THE PALMS OF BRITISH INDIA AND CEYLON, INDIGENOUS AND INTRODUCED.

BY

E. Blatter, S.J.

Part XIX.

(*With Plates C to CIII and 8 text figures.*)

ZALACCA, Reinw. Syll. Pl. Soc. Bot. Ratisb. II, 3.

("Zalacca" is said to be the name of this genus in the Moluccas.)

Gaertn. Fruct. I. 139.—Bl. Rumph. II, 158.—Wall. Pl. Asiat. Rar. III, t. 222.—Mart. Hist. Nat. Palm. III, 199, 325, t. 118, 119, 123, 136, 159, fig. 3, 173, 174.—Kunth Enum. Pl. III, 202.—Walp. Ann. V, 826.—Miq. Fl. Ind. Bat. III, 80.—Griff. Calc. Journ. Nat. Hist. V. 6.—Kurz. For. Fl. II, 511.—Benth. & Hook. Gen. Pl. III, II, 932, 103.—Hook. Fl. Brit. Ind. VI, 472.

Stemless, soboliferous, armed palms. Leaves pinnatisect, not flagelliferous. Leaflets narrowly linear-lanceolate.

Spadix interfoliar, pendulous, flowering branches catkin-like. Spathes persistent; lower sheathing, incomplete; bracteoles cupular, 2-celled; flowers coriaceous, densely crowded, polygamous. Male flowers: calyx tubular, 3-fid; corolla tubular, segments valvate; stamens 6, anthers short. Female flowers larger; perianth accrescent; calyx trifid; corolla-lobes lanceolate, valvate; staminodes 3-6; ovary 3-celled, stigmas 3, subulate; ovules basilar.

Fruit globose or obovoid, 1-3-seeded, clothed with reversed or spreading scales. Seeds 1-3, erect, top excavated; testa crustaceous; outer coat fleshy; albumen equable; embryo subbasilar.

Species 10.—Indo-Malayan.

Cultivation in Europe.—The species of this genus are stove plants. They thrive in strong loam and river sand, in moist heat. The pots must be well drained to prevent any stagnation.

ZALACCA SECUNDA, Griff. in Calc. Journ. Nat. Hist. V, 12; Palms Brit. Ind. 14, t. 177; Becc. Males. III, 673.—*Calamus collinus*, Griff. Palms Brit. Ind. t. 186 (leaf only).

This species is very imperfectly known. Griffith describes the male spadix before the opening of the flowers and gives the figure of an incomplete leaf, whilst Hooker was in possession of a leaflet, a young fruit, and some ripe fruits in a broken condition.

Leaves 30 feet long; leaflets 33 inches long, nearly 3 inches broad, straight, coriaceous, concolorous, with 3 stout costæ acute on both surfaces and spinulose beneath, margins setulose above the middle.

Male spadix compact, about 2 feet long, slightly curved, closely imbricated with the scarious, striated, split spathes. Spikes stalked, exserted; stalks nearly as long as the spathes, also covered with imbricated spathes, the uppermost of which resemble those of the flowers, except in not producing any villosity. The spikes themselves are 2½ and 3 inches long, and scarcely ½ inch in diameter, the bracts both of the base and apex appearing to be empty.

Female spadix paniculately branched, spikes tomentose. Male flowers: bracts rounded, distinct, and presenting on the outer side of each flower a tuft of hair. Flowers densely crowded, so that their disposition is not at first apparent, the buds depressed at the apex. Calyx tripartite to about the middle, scarious, striate, segments oblong, concave. Corolla (which was not seen by Griffith in an expanded state) about the length of the calyx, divided not quite to the middle, segments oblong, concave. Stamens united to the petals as high as the base of the segments. Filaments (free) obsolete. Anthers oblong. Female flowers? Fruit appears to be ovoid, 2 inch? long, ending in a stout cone; pericarp thin, clothed with spreading and ascending subulate-lanceolate, recurved, dark brown scales ¼ inch long and under; no appearance of a succulent endocarp. Seeds 1-1¼ inch long, various in shape, from subglobose to hemispheric or trigonous with a convex back, and very rounded angles, dark brown, not polished, with a deep small, apical hollow leading to the canal which extends more than half way into the dense albumen; embryo above the base dorsal or sublateral, indicated externally by a circular convexity with depressed margins ¼ inch in diameter or less.

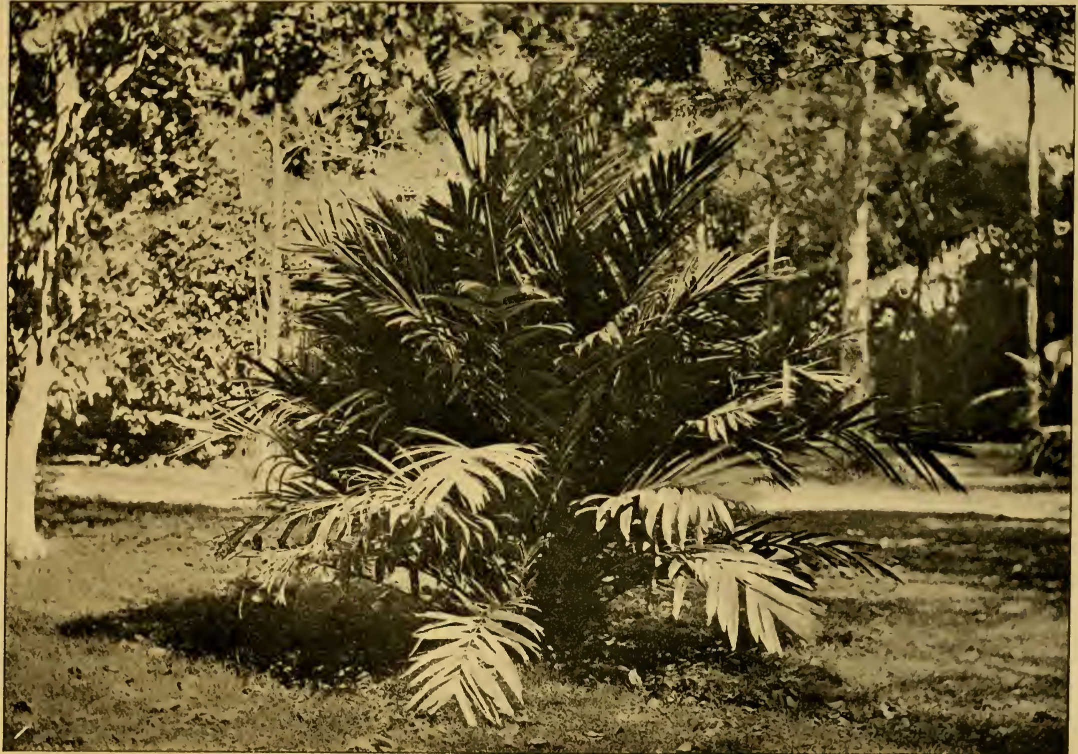
HABITAT.—Upper Assam, in forests about Kujoo; the Mishmi Mountains, and on the lower ranges of hills on the borders of Upper Assam.

ZALACCA WALLICHIANA, Mart. Hist. Nat. Palm. III, 200, 325, t. 118, 119, 136; Kurz in Natuurk. Tijdschr. Ned. Ind. XXVII (1864), 216; For. Fl. II, 511; Becc. Males. III, 66; Hook. Fl. Brit. Ind. VI, 473; Brandis Ind. Trees, 649.—*Zalacca edulis,* Wall. Cat. n. 5000; Pl. As. Rar. III, 14, t. 222-224; Griff. in Calc. Journ. Nat. Hist. V, 8; Palms Brit. Ind. 10, t, 175.—*Z. rumphii*, Blume Rumphia II, 159.—*Z. macrostachya,* Griff. ll. cc. 13 and 15, t. 178, A, B, C; Becc. l. c. 66.

Brandis refers *Z. edulis*, Reinw. to *Z. wallichiana*; and in this he is following Griffith (Palms Brit. Ind. 10); Hooker, on the contrary says: "The Malayan *Z. edulis*, Reinw., not hitherto found in the Malayan Peninsula, has the leaflets white beneath."

Griffith's *Z. macrostachya* has been referred to *Z. wallichiana* by Beccari. He says, that it is a much stouter form with oblanceolate leaflets and spikes 3 inches long and nearly 1 inch in diameter.

NAME.—Yingan (Burm.).



Zalacca Wallichiana, Mart.

An evergreen, large, tufted, stemless or almost stemless palm, 12-20 feet high or somewhat higher, all parts glabrous. Leaves 15-20 feet long, pinnate; petiole 8-10 feet long, sheathing at the base, copiously armed with 1-1½ inch long, flat, sharp, somewhat reflexed spines arranged in broken spirals; the rhachis similarly armed, but the spines becoming gradually solitary towards the upper part; leaflets inequidistant and alternate, broad-lanceolate, 3-ribbed, 2-3 feet long, distantly spinulose-ciliate, green on both sides, subulate and almost tendril-like acuminate, the upper leaflets confluent, 2-cleft, with as many lobes as leaflets united.

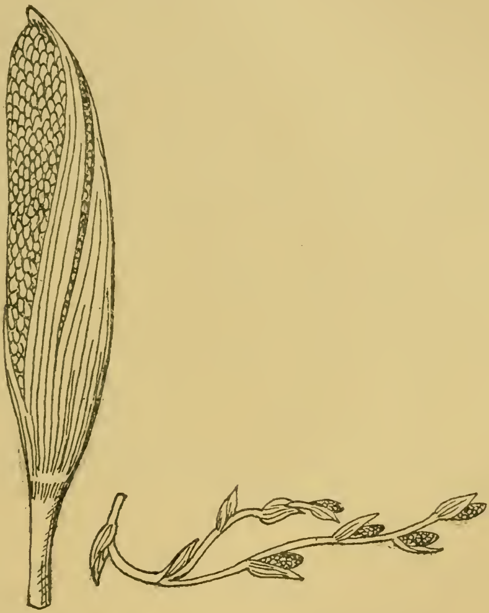


FIG. 1—
To the left: Terminal spike of spadix of *Z. wallichiana*. Mart.
To the right: Upper part of spadix of the same (after Griffith.)

Spadix elongate, fastigiately branched, dimorphic, one male only, with densely tomentose spikes, the other monœcious, very dense-flowered (fig. 1); each bract seems to correspond to a cluster of 3 flowers, a female between 2 males or neuters, and with 2 densely tomentose bracteoles; rhachis densely but shortly brown-scurfy.

Flowers small, rose-coloured, in short, cylindrical, pale rose-coloured, villous spikes, about 3 or more times shorter than the narrow, variously ruptured, partial spathes. Calyx divided to the base, sepals obovate-oblong, about 1¼ lin. long; corolla nearly twice as long, rigid, rose-coloured.

Drupes in dense heads, obovoid, apiculate or almost acuminate, 1 inch long or more, densely retrorsely scaled, 3-1-celled with as many arillate seeds, the scales brown, rather rigid, cordate-ovate, only the upper parts exposed and terminating in a reflexed brittle bristle up to 1½ lin. long.

HABITAT.—Frequent in the tropical forests all over Pegu and Martaban down to Tenasserim, Penang and Singapore; Siam; Banca.

Flowers during the cold season; fruit ripens in June and July.

ILLUSTRATION.—The specimen of *Zalacca wallichiana* which is figured on Pl. C. may be seen in the Botanic Gardens of Sibpur. The photograph was supplied by Major Gage.

ZALACCA BECCARII, Hook. f. in Hook. Fl. Brit. Ind. VI, 474.

Leaflets 18-24 inches long, 1½ inches broad, apparently equidistant, strict, concolorous, shining on both surfaces, elongate-ensiform, acuminate, tips shortly filiform, margins with strong straight setæ almost throughout their length, mid-rib stout, lateral slender, all with few scattered, black, ¼-⅓ inch long bristles; very young leaflets pale beneath, with very long, slender, pale bristles on the ribs; rhachis with short, hooked, black claws.

Female spadix 3 feet long or more; rhachis brown woolly; lower spathe 1 foot long, upper 4-6 inches long. Spikes 2½ inch long, ¾ inch in diameter; bracts woolly; flowers ¼ inch long; sepals and petals subequal, broadly ovate, acute.

Fruit apparently small, fruit-scales pale chestnut, with broad bases and paler recurved spinous tips.

Can easily be distinguished from *Z. wallichiana* by the long, strict leaflets with long bristles, short tips, and margins armed throughout their length. (Hooker).

HABITAT.—Rangoon.

KORTHALSIA, Bl. in Rumph. II, 166, t. 130, fig. 2.

(After Peter Korthals, a botanist of Haarlem, who explored the East Indies.)

Mart. Hist. Nat. Palm. III, 210, 343, t. 172, fig. 1.; Bl. Rumph. III, t. 157, B (*Ceratolobus*).; Miq. Fl. Ind. Bat. III, 74, 750, Suppl. 591.; Griff. Palms Brit. Ind. 26, t. 183, 184 (*Calamosagus*).; Walp. Ann. III, 492.; Kurz For. Fl. II, 512.; Wendl. Bot. Zeitg. 1859, 174.; Becc. Males. I, 87; Benth. & Hook. Gen. Pl. III, II, 932, 104.; Hook. Fl. Brit. Ind. VI, 474.

Scandent, spinous, leaves pinnatisect; leaflets more or less cuneate or trapezoid and erose; rhachis flagelliferous; petiole short, sheath often produced into a large ligule (ochrea).

Spadix axillary, loosely branched, pendulous, sheathed with tubular persistent spathes; bracts membranous; bracteoles reduced to hairs. Flowers bisexual, crowded in cylindric catkin-like spikes; sepals orbicular or oblong; petals ovate or lanceolate, valvate; stamens 6 or more, filaments short, anthers linear; staminodes 6 or more; ovary imperfectly 3-celled; ovules basilar.

Fruit globose or ovoid, 1-seeded; pericarp thin, tessellate with recurved shining scales. Seed erect, top hollowed, chalaza lateral; albumen ruminate; embryo ventral. Species about 20, Indian and Malayan.

Cultivation in Europe.—An elegant genus of stove palms. When young, they are most effective as drawing or dining room decorations; and when in a more mature condition, they are excellent as stove ornaments and for exhibition purposes. They are easily cultivated in a compost of equal parts loam and vegetable mould. Plenty of water is required. They are propagated by seeds.

KORTHALSIA LACINIOSA, Mart. Hist. Nat. Palm. III, 211; Kurz in Journ. As. Soc. Beng. XLIII, II (1874), 207; Becc. Males. II, 74 (excl. pl. Salangore); Hooker, Fl. Brit. Ind. VI, 475.—*K. scaphigera*, Kurz l. c. 206 (excl. omnib. syn.), t. 20, 21; For. Fl. II, 513 (not of Mart.).—*K. andamanensis*, Becc. Males. II, 76.—*Calamosagus laciniosus*, Griff. in Calc. Journ. Nat. Hist. V, 23, t. 1; Palms Brit. Ind. 27, t. 183.

Stems slender, ½ inch in diameter. Leaves 2-4 feet; leaflets subapproximate, 4-7 inches long, rhomboid, ovate or trapezoid, about as long as broad, acutely erosely toothed, terminal one broadest, fugaceously white tomentose beneath; ochrea dilacerate, sparingly armed; petiole 1½-2 feet long, with straight spines, angular above, slightly convex below; rhachis and flagellum with reversed claws.

Spadix much branched, and covered with imbricate, smooth spathes, with short, oblique, acute, suberect limbs; branches axillary, widely spreading, similarly covered with spathes, from which the spikes project. Spikes 3-4 inches long, 3-4 lines broad, tawny-tomentose, very compact, the pedicels almost entirely enclosed. Bracts rounded and imbricate, the lowermost empty, a little longer than the villous bracteoles. Flowers appear to be solitary, half immersed in the wool, which is exceedingly dense. Calyx short, with 3 broad, acute teeth. Corolla deeply tripartite, segments oblong, spreading, exserted. Stamens 6, united to the corolla at the base of its segments; free portion of the filaments broad, very short, united into a short annulus; anthers large, linear, subsagittate. Ovary occupying the corolla-tube, surrounded by the filaments, covered with toothed scales, after fecundation becoming exserted. Style subulate, rather long, minutely 3-toothed at the apex.

Fruit ½ inch long, obovoid, mucronate, with greenish, brown-margined scales. Seed with a large excavation superiorly, filled with a brown, cellular substance; albumen horny, ruminate. Embryo obconical, ventral.

HABITAT.—Burma, Andaman and Nicobar Islands.

PLECTOCOMIA, Mart. and Bl. Schult. Syst. VII, 2, 1333.

(From the Greek "Plectos," plaited, and "comè," hair.)

Mart. Hist. Nat. Palm. III, 198, 325, t. 114, 116, Fig. 11, 12.; Bl. Rumph. III, 68, t. 158, 159, 163; Kunth Enum. Pl. III, 202.; Griff. Palms Brit. Ind. 103, app. 20, t. 217-219.; Bot. Mag. t. 5105.; Miq. Fl. Ind. Bat. III, 78. suppl. 592.; Kurz. For. Fl. II, 514.; Walp. Ann. III, 474.; Wendl. Bot. Zeitg. 1859, 165.; T. Anders. Journ. Linn. Soc. XI, 11; Benth. and Hook. Gen. Pl. III, II, 934, 107.; Hook. Fl. Brit. Ind. VI, 477.

Scandent, monocarpic, spinous palms; stem very long. Leaves flagelliferous; leaflets linear-lanceolate.

Spadix simply branched; branches very long, pendulous, clothed with closely imbricating distichous, inflated, coriaceous, persistent spathes which conceal the spicate, diœcious flowers. Spikelets short, male many-flowered, female shorter, few-flowered; bracts and bracteoles subulate. Male flowers: Calyx cupular, 3-toothed, petals lanceolate, valvate; stamens 6-12, filaments cuneate below, anthers linear. Female flowers larger, perianth accrescent; corolla 3-fid, lobes valvate; staminodes 6. Ovary 3-celled; ovules basilar.

Fruit globose, 1-, rarely 3-seeded, beaked; pericarp thin, tessellated, with reflexed shining scales. Seed erect; albumen equable; embryo basilar.

Species 6—Himalayan and Malayan.

Cultivation in Europe.—Very handsome stove plants and of easy cultivation. A compost of loam and peat, in about equal parts, is suitable. Freely propagated by suckers.

PLECTOCOMIA KHASIYANA, Griff. in Calc. Journ. Nat. Hist. V, 106; Palms Brit. Ind. 106. t. 218; Mart. Hist. Nat. Palm. III, 199; Hook. Fl. Brit. Ind. VI, 478.—*P. Assamica*, Hook. Bot. Mag. t. 1505 (excl. syn.).

Stem 60-80 feet, as thick as the arm. Leaves 30 feet, including the flagellum; leaflets 8-16 inches long, 2-3 inches broad, broadly lanceolate, strongly 3-ribbed, finely furfuraceous beneath tip, not filiferous; rhachis armed beneath with very short digitate spines.

Male spadix branched from the base; branches 3 feet long by 2 feet across the spathels, which are 1½ inch long, oblong, white, with broad, green, acute or acuminate tips and a broad, brown, interposed band (fig. 3). Spikelets 1-inch, many-flowered; petals ⅓ inch long, elongate-lanceolate; stamens 8-12. Female spadix: Spathes of the peduncle with erect, oblong-lanceolate limbs; flower-bearing branches 1-2 feet long, secund, pendulous; spathes at the base half amplectent, rather distant, distichous, and laxly imbricated; outline obovate, towards the apex broadly obcuneate, margins below this part incurved; spikes concealed by the spathes, furfuraceous, 3 or 7-flowered; flowers distichous, large; calyx flat, small, divided almost to the base into 3 triangular, mucronate, smooth teeth; corolla divided almost to the base into 3 ascending, lanceolate, acuminate segments, 4-4½ lines long; staminodes 6; ovary broadly globose, covered with exceedingly numerous, shortish, very fimbriate scales with multifid points, 3-celled; style very short, stout, with 3 stout, subulate, spreading branches as long as the petals, channelled and stigmatic on their inner faces.

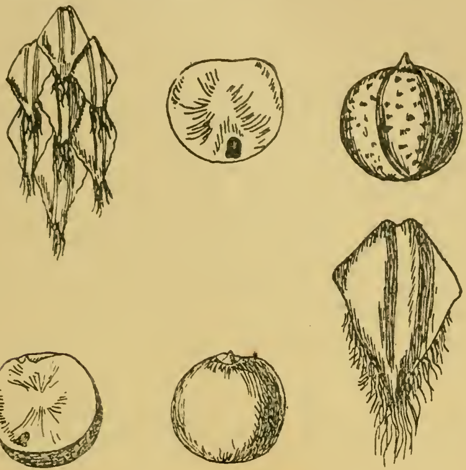


Fig. 2—
Upper row: *Plectocomia khasiyana*,
Left: Scales of fruit much magnified.
Middle: Section of seed, natural size.
Right: Seed enclosed in the flesh, natural size
Lower row: *Plectocomia assamica*.
Left: Section of seed.
Middle: Seed.
Right: Scale of fruit (after Martius).

Fruit 1-1¼ inch in diameter, globose, abruptly beaked, surrounded at the base by the calyx, and corolla now flattened out, dark brown; scales very numerous, rather small, either nearly smooth, or with ciliate margins and recurved, split, fimbriate points. Seed covered with a rather thick, brown, cellular, spongy substance; albumen solid, horny; embryo basilar (fig. 2).

Habitat.—Khasia Hills, 4-5,000 feet.

PLECTOCOMIA HIMALAYANA, Griff. in Calc. Journ. Nat. Hist. V, 100; Palms Brit. Ind. 108, t. 219; Mart. Hist. Nat. Palm. III, 199; T. Anders. in Journ. Linn. Soc. XI, 12; Hooker Fl. Brit. Ind. VI, 478.—*P. montana*, Herb. Ind. Or. Hook f. & Th.

NAMES.—Takri Bet (Nep.); Ranul (Lepcha); Rattan Palm (Engl.).

Stem 1 inch in diameter. Leaves 6-8 feet long, including the flagellum; leaflets 12-16 inches long, 1-1½ inch broad, alternate, linear-lanceolate, very acuminate, narrowed into filiform tips, 2-3 inches long, with five prominent veins on the upper surface, margins with short, sub-appressed spinescent teeth; rhachis scurfy; the pinniferous part of the petiole armed below with stout, hooked prickles, confluent at the base; prickles in increased number on the flagellum; petiole unarmed or margins spiny; sheath tubular, scurfy; spines whorled.

Spadices erect; branches 2-3 feet long, covered with rust coloured tomentum; spathes almost stem-clasping, conduplicate, coriaceous-scarious; spathels 1-2 inches long, rhomboid, acute; spikelets 3-7-flowered, scurfy, tomentose. Male flowers supported by 3 narrow, bristle-pointed, scarious bracts, sub-distichous; calyx cupular, with 3 short, rounded teeth ending in bristles; petals ¼ inch long, ovate-lanceolate. Stamens 6, united at the base into a short cup; filaments stoutish, subulate; anthers large, linear-oblong, obtusely sagittate. Female flowers?

Fruit ½ inch in diameter, depressed-globose; scales very small, fimbriate, tips appressed.

HABITAT.—Sub-Himalayan ranges about Darjeeling, 4-7,000 feet, common.

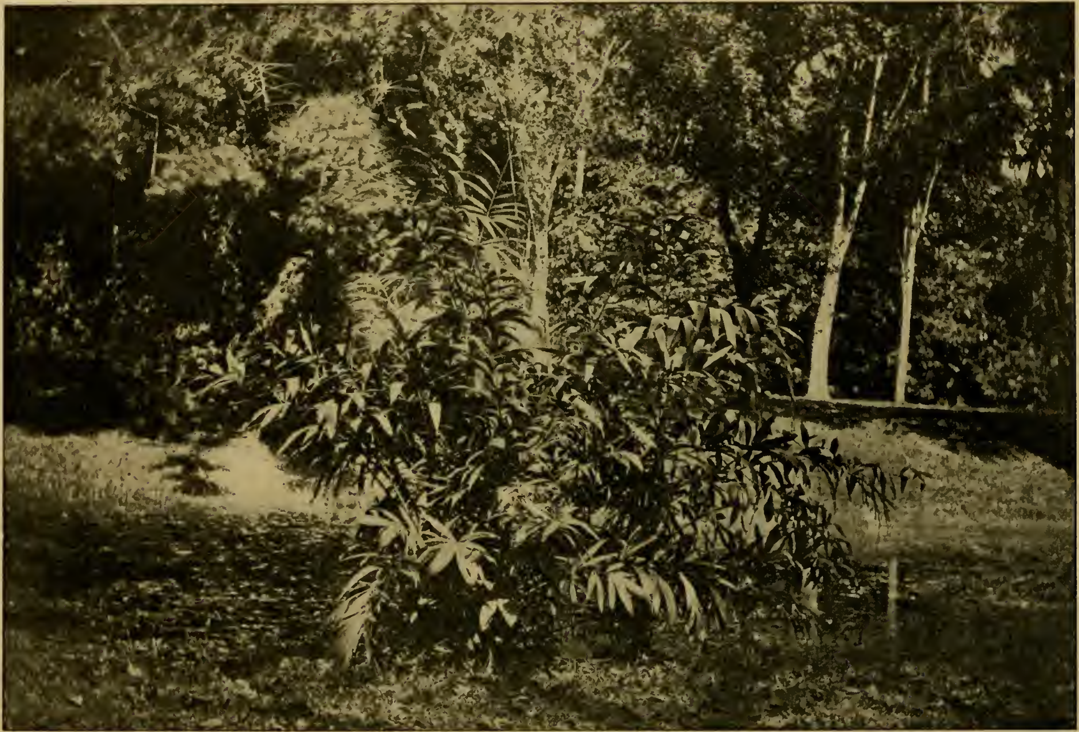
PLECTOCOMIA MACROSTACHYA, Kurz. in Journ. Asiat. Soc. Beng. XLIII, II, 207, t. 16, 17; For. Fl. II, 514; Hook. Fl. Brit. Ind. VI, 478; Brandis Ind. Trees, 650.

NAME.—Kyeinbam (Burm.).

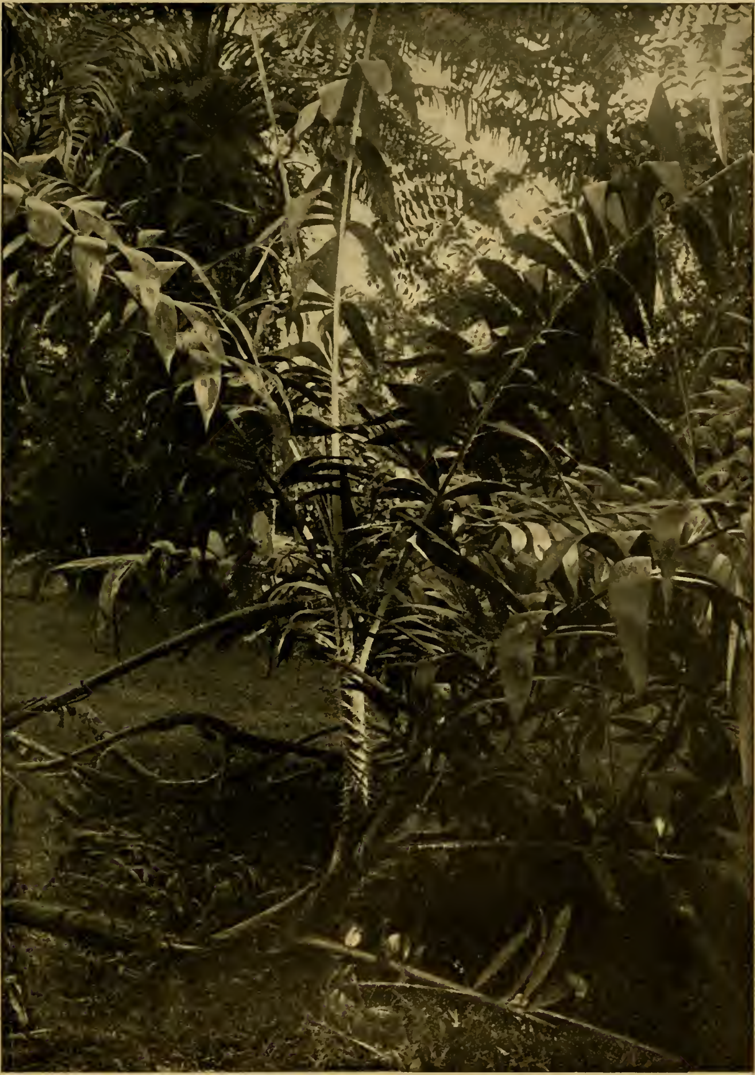
An evergreen lofty climber, all parts glabrous. Leaves pinnate, the petiole and rhachis spiny, spines straight, up to ⅓ inch long; leaflets (median ones) somewhat approximate by pairs, linearlanceolate, ½-2 feet long, long-acuminate, white-powdery beneath, 3-ribbed, 2 of the ribs marginal, coriaceous, but rather flaccid.

Branches of male spadix 4-5 feet long, pendulous, closely covered with broadly obovate distichous imbricating spathels, brown with black border, in the axils of which are the spikelets, shorter than bracts with alternate, distichous flowers. Male flowers: calyx wide, cup-shaped, about 1 line deep, shortly 3-toothed, the teeth acute, bordered, especially in their sinuses, by a dense, brown, woolly tomentum; petals rigid, falcate, lanceolate, sharply acuminate, about ⅓ inch long or somewhat longer, sulcate outside; stamens 6.

Drupes ¾-1 in diameter.



Plectocomia assamica, Griff.



Plectocomia elongata, Mart.

Habitat—Tenasserim: Bithoko range, between the Yunzalin and the Salween at Great Rapids, 3,000 feet elevation.

PLECTOCOMIA ASSAMICA, Griff. in Calc. Journ. Nat. Hist. V, 97, Palms Brit. Ind. 107, t. 218, a; Mart. Hist. Nat. Palm. III, 199, t. 176 f. 11.

Leaves very large; leaflets 18-24 inches long, 2-2½ inches; broad, white, finely furfuraceous beneath, tip not thread-like, ribs slender, lateral ribs marginal; petiole 1½ inch broad, with short, stout, marginal spines and short, seriate, scattered clusters of more slender, dorsal ones.

Branches of fruiting spadix 4-5 feet long by 4-5 inches across the large, subacute, nearly glabrous spathels, scurfy, rhachis rusty tomentose; spathels 2½-inches long. Spikelets 8-10-flowered. Male calyx cupular, 3-toothed, sepals broadly ovate, ¼ inch long, petals lanceolate, ⅓-½ inch long. Fruiting sepals broadly ovate, ¼ inch long; petals lanceolate, ½ inch long.

Fruit, when dry, of a rich ferruginous brown colour, about 1 inch in diameter, surrounded at the base by calyx and corolla, terminated by a style tripartite almost to the base with subulate connivent branches, one-celled, very villous from the highly ciliate, fimbriate, split, recurved points of the scales. Albumen cartilaginous, solid, its tissue radiating from the centre; embryo basilar (*see* fig. 2).

Habitat.—Upper Assam.

Illustration.—The tuft of *Plectocomia assamica* represented on Pl. CI grows in the Bot. Gard. of Sibpur. We have to thank Major Gage for the photograph.

PLECTOCOMIA ELONGATA, Mart. in Roem. & Sch. Syst. VII. 1333, Hist. Nat. Palm. 199, t. 114 and 116, f. 1; Kunth Enum. III, 202; Blume Rumphia, III, 68, t. 158 and 163 A; Hook. f. Fl. Brit. Ind. VI, 479.—*C. maximus*, Reinw., ex Blume Cat. Hort. Bogon. 59.

Leaves very large; petiole short; leaflets 1-1½ foot long, 2 inches broad, rather membranous, sparsely white furfuraceous beneath, tip not filiferous, costæ 3, very slender, lateral costæ marginal.

Branches of spadix 3-4 feet long, 2-3 inches across the spreading spathels (fig. 3). Spathels 1½ inch long, sub-3-lobed, acute, glabrous. Flowers very small; calyx of male minute, 3-toothed; petals ¼ inch long, obliquely oblong-ovate, acute. Calyx of female larger, urceolate, 3-toothed, petals small, linear-lanceolate.

Fruit 1 inch in diameter, densely villous from the long lacerate spreading tips of the scales.

Habitat.—Penang, Sumatra, Java.

Illustration.—Mrs. Burkill was kind enough to take a photograph of the specimen of *Plectocomia elongata* which grows in the Bot. Gard. of Singapore (Plate CII).

CALAMUS, L. Gen. Pl. ed. 1764. 173, No. 436.

(From the Greek "Calamos," a reed or cane).

Mart. Hist. Nat. Palm, III, 207, 331, t. 112, etc.; Gærtn. Fruct. II, t. 139; Bl. Rumph. III, 28, t. 146, 154, 163.; Griff. Calc. Journ. Nat. Hist. V, 26; Miq. Fl. Ind. Bat. III, 103, 719.; Kurz For. Fl. II, 515.; Benth. Fl. Austr. VII, 134.; Wendl. Bot. Zeitg. 1859, 158; Drude Bot. Zeitg. 1877, 637; T. Anders. Journ. Linn. Soc. XI, 8.; Luers. Botan. II, 331.; Hook. Fl. Brit. Ind. VI, 436; Becc. in Ann. Roy. Bot. Gard. XI, 61.

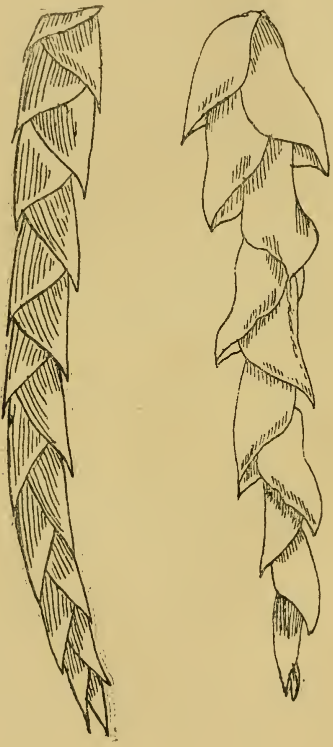


Fig. 3—

Left: Tip of female spike of spadix of *Plectocomia elongata*.

Right: Tip of spike of *Plectocomia khasiyana*.

Perennial, armed, tufted palms, rarely erect, usually climbing means of hooked spines on the rhachis of the leaves, or by whip-like spinous prolongations (flagella) of the rhachis, or of the spadix, or of the leaf sheath; stem simple, cylindric, ringed at the nodes, upper internodes clothed with spinous leaf-sheaths. Leaves pinnatisect, rarely digitate, alternate; leaflets few or many, lanceolate, rarely broad, acuminate, nerves parallel; sheath armed, produced into a ligula or ochrea and with or without a lateral armed flagellum. Spadices axillary, usually elongate, much branched, armed, sometimes produced into a spinous flagellum. Spathes tubular or open, sheathing the peduncle and branches of the spadix, and passing into bracts and bracteoles (spathels and spathellules). Flowers small, usually polygamo-diœcious, in usually distichous often scorpioid spikelets, solitary or binate (a female or male or both) in the bracteoles. Male flowers: calyx cupular, 3-lobed or 3-toothed, coriaceous; petals 3, acute, coriaceous, valvate, sometimes combined at the base into a stipes; stamens 6, filaments short, anthers dorsifixed, versatile. Female flowers slightly accrescent; calyx as in male; corolla tubular below, 3-fid, valvate; staminodes forming a cup; ovary incompletely 3-celled, clothed with retrorse scales; style short or rather long; stigmas 3; ovule basilar, erect, (Fig. 4 and 5.)

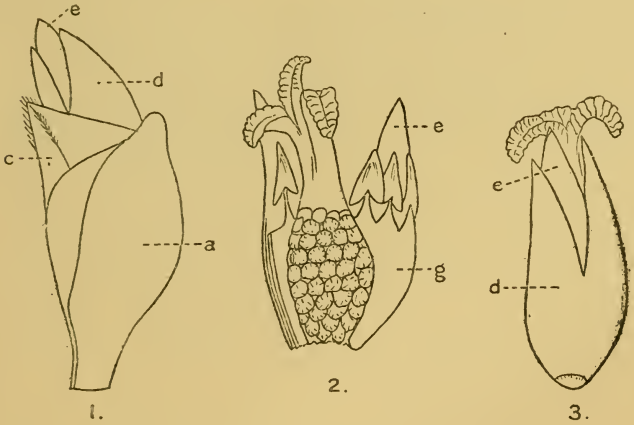


FIG. 4—*Calamus griffithianus.*

1 Female flower with its involucre still closed: back view of the involucrophorum (*a*).

2. Female flower cut open; g = staminal tube.

3. Female flower without involucre; d = calyx, e = corolla.

Enlarged 6 diam. (After Beccari).

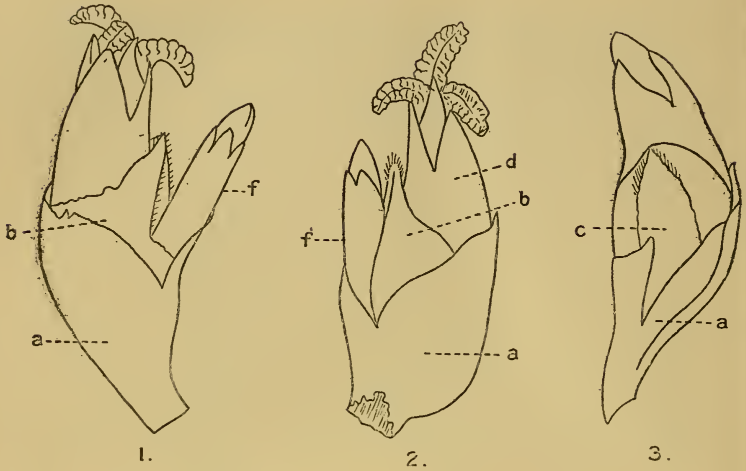


Fig. 5—*C. griffithianus.*
1. Female flower during anthesis.
a=involucrophorum, b = involucre, f = neuter flower.
2. Another female flower with its involucres during anthesis.
3. Female flower with its involucre still closed. c = areola.
Enlarged 6 diam. (After Beccari).

Fruit globose or ellipsoid, usually strongly beaked; style terminal; pericarp thin, clothed with appressed deflexed closely imbricating polished scales. Seed subglobose or oblong, smooth or pitted; albumen equable or ruminate; embryo ventral or basal.

Species over 200.—Tropical and sub-tropical Asia, Malaya, Philippines, New Guinea, Australia, and a few in tropical Africa.

The Calami are mostly leaf-climbers with thin reedy stems. In some species there are hooks on the back of the midrib, but the more common type of leaf is one in which the leaflets at the outer end of the leaf are represented by stout spines pointing backwards. The leaf shoots almost vertically out of the bud up among the surrounding vegetation, and the hooks take hold. The stem often grows to immense lengths (500-600 feet).

Economic importance.—" The Forest Departments of the various provinces in India, including Burma, publish annual reports from which it might be gathered that the yearly crop of canes amounts to about 10,000,000 maunds and the annual revenue therefrom from Rs. 50,000-60,000. The Reports of the Conservators of Forests in Burma for the year 1904-5, for example, show a total revenue from canes amounting to Rs. 37,775. The imports of canes and rattans into India from foreign countries may be said to average from 30,000 to 40,000 cwts., valued at from 2 to 3½ lakhs of rupees (38,436 cwts. valued at Rs. 3,85,674 in 1906-7). These come mainly from the Straits Settlements and Siam. The exports to foreign countries of Indian canes come to from 1,000 to 3,000 cwts., valued at from Rs. 20,000 to Rs. 50,000 (2,427 cwts., valued at Rs. 38,100 in 1906-7), but in addition there is also a re-export trade formerly of about the same quantity and value as that just mentioned, but showing a considerable diminution in recent years (673 cwts., Rs. 11,291, in 1906-7). It is thus significant that India, with its vast supplies of canes and rattans should not be independent of foreign tropical countries, and the explanation may possibly lie in the cheaper sea as compared with land transit. Large towns like Bombay, Calcutta, and Madras find it more economical to obtain their supplies from the Straits than from the inland forests of India." (Watt).

Popular names for Calamus in general and its products:

FOR THE PALM.

English: Canes, rattan, rattan palm, reed palm, rotang.

French: Canne épineuse, ratan, rotain, rotang, rotin.

German: Binsenhalm, Binsenstengel, Rohrpalme, Rotangpalme, Rottang, Schilfpalme.

Dutch: Palmriet, rotanpalm, rotan, rottangpalm, rottan, rottanpalm, rotting, rottingriet, rottinggewas, spaansch riet.

OF THE CANE.

English: Ratoon, rattan, rattan cane.

French: Canne à main, jonc, jonc d'Inde, rotan, rotin.

German: Handratting, Malaccarohr, Manillarohr, Rohr, Spanisches Rohr, Stockrohr, Zuckerrohr.

Dutch: Rotting, spaansch riet.

OF THE WOOD.

English: Cable cane, chair-bottom cane.

French: Liane d'amarrage?, rotang à cordes, rotang à meubles.

German: Bindrohr, Bundrohr, Ratang, Rattan, Rohr, Rotang, Rotting Schnurrohr, Stuhlrohr.

Dutch: Bindrottan, bindrotting.

Of native generic names for Calamus we mention the following taken from Beccari:—

In Ternate: Uri.
In Makassar: Boucan.
In Banda and Amboina: Ua.
In the Philippines: Bejuco.
In Java: Penjalin, Hoeh, Hooek.
In China: Khoë, Khoëa.
In Cochin China: May.
Hindustani: Bet.
Sanskrit: Vetra, Vetus.

Cultivation in Europe.—"Although the species of Calamus, the cultivation of which has been attempted in the hot houses of extra-tropical countries are pretty numerous, the number of those which have become permanently established is small, owing to its being very difficult to provide them with conditions of existence like those enjoyed in their native countries. The Calami in our hot houses therefore give but a faint and poor idea of the elegance of their foliage as it appears at the summit of a long, slender and climbing stem. Young plants of Calami are, however, considerably appreciated by horticulturists on account of their highly ornamental, bright green, graceful pinnate leaves, so that they are frequently offered for sale in commercial catalogues of leaving plants.

"In cultivation Calami thrive best in a compost of equal parts of sandy loam and vegetable soil formed by decomposed leaves. They require a warm moist atmosphere and copious watering. I have however to observe that Calami grow in very different situations, from marshy plains at the level of the sea up to an elevation of 2,000 metres in the mountains, so that in the cultivation of Calami, as in that of any other plant, it is necessary to know beforehand the natural conditions of their existence and to modify their cultural conditions accordingly. If this be borne in mind, it may be found that probably not a few of the mountain species of Calamus, as for instance those of the Himalaya and Assam, will thrive better in the temperate than in a warm hot-house, while others should receive the treatment of aquatic plants in warm water." (Beccari).

CONSPECTUS OF THE SPECIES.[1]

A.—LEAVES NEVER CIRRIFEROUS.

Group I.—Leaflets many, elongate. Primary spathes elongate-tubular, dilated and lacerate in their upper part. Spadix with their partial inflorescences and spikelets provided with a pedicellar part which remains included in their respective spathes. Fruiting perianth explanate (not forming a pedicel to the fruit). Involucrophorum of the female spikelets short, not pedicelliform. Seed with ruminate albumen; embryo basilar or nearly so:

a. Stem erect. Leaf-sheaths not flagelliferous.

1. *C. erectus.*

b. Scandent. Leaf-sheaths flagelliferous.

2. *C. flagellum.*

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[1] In this and the following descriptions of the species of Calamus I could not do better but to copy from Beccari's admirable Monograph on "The Species of Calamus," which appeared as Vol. XI of the Annals of the Royal Bot. Gard., Calcutta. It had been my intention to omit his genus altogether; but some Botanists in Europe advised me to include it. Two reasons induced me to follow their advice, on the one hand, the fact that unfortunately very few people have access to Beccari's work, on the other, the more selfish consideration that my series on the Indian Palms would be incomplete by excluding the Genus Calamus, a genus which is better represented in India than any other.

Group II.—Leaflets numerous, elongate. Primary spathes elongate-tubular, more or less lacerate in their upper part. Fruiting perianth explanate. Involucrophorum short, not pedicelliform. Seed (where known) with equable albumen and basilar embryo:

a. Spikelets not inserted at the bottom of their respective spathes and therefor not or very shortly pedicellate:

* Not scandent. Spadix not flagelliform, and armed only with straight spines.

3. *C. arborescens.*

** Scandent. Spadix flagelliform, clawed on the axial parts between the partial inflorescences.

4. *C. longisetus.*
5. *C. thwaitesii.*
6. *C. leptospadix.*

b. Spikelets inserted at the bottom of their respective spathes and provided with a distinct pedicellar part.

7. *C. dilaceratus.*

Group III.—Leaflets very few, pinnate, digitate or radiate. Primary spathes very narrow and elongate-cylindric, very closely sheathing. Leaf-sheaths flagelliferous. Spadices (male and female) simply decompound, very slender and flagelliform; partial inflorescences and spikelets inserted at the mouth of their respective spathes (not with a pedicellar part). Fruiting perianth explanate. Involucrophorum not pedicelliform. Seed with equable albumen and basilar embryo.

8. *C. pachystemonus.*
9. *C. digitatus.*
10. *C. radiatus.*

Group IV.—Leaves pinnate. Leaf-sheaths provided in the scandent species (when not bearing spadices) with a long-clawed flagellum; in the non-scandent species the flagellum rudimentary or none. Primary spathes very elongate-tubular, closely sheathing, sometimes split longitudinally in their upper part, but never entirely opened longitudinally and laminar. Spikelets inserted at the mouth of their respective spathes. Involucrophorum not pedicelliform. Seed (where known) not ruminate; embryo basilar.

a. Fruiting perianth (where known) explanate or subcallous at the base, not or slightly pedicelliform.

† Leaves pinnate with few often broad-lanceolate or elliptic or more rarely elongate, 3-5-costulate leaflets, all the costæ reaching the apex.

* The two terminal leaflets highly connate.

11. *C. floribundus.*

** The two terminal leaflets free at the base.

12. *C. kingianus.*

†† Leaves with numerous leaflets, these narrow, often fascicled, usually gradually decreasing towards the apex, the two of the terminal pair the smallest and free at the base.

* Fruiting perianth entirely explanate.

13. *C. viminalis.*
14. *C. concinnus.*
15. *C. rivalis.*
16. *C. pseudo-rivalis.*
17. *C. metzianus.*
18. *C. pseudo-tenuis.*

** Fruiting perianth slightly callous at the base and more or less pedicelliform.

20. *C. delicatulus.*
21. *C. helferianus.*
22. *C. nicobaricus.*

b. Fruiting perianth distinctly pedicelliform.

* Leaflets numerous, narrow, equidistant, gradually becoming smaller towards the apex of the leaf.

23. *C. tenuis.*
24. *C. rotang.*
25. *C. delessertianus.*

** Leaflets not very numerous, and distinctly fascicled.

26. *C. Brandisii.*

*** Leaflets more or less inequidistant, but not fascicled, many-nerved.

27. *C. acanthospathus.*
28. *C. feanus.*

Group V.—Leaflets elongate. Primary spathes very long, tubular and closed at first, later longitudinally split and open, loriform or laminar. Involucrophorum not pedicellate. Seed (where known) not alveolate, with equable albumen.

29. *C. guruba.*
30. *C. nitipus.*
31. *C. platyspathus.*
32. *C. myrianthus.*
33. *C. hypoleucus.*
34. *C. leucotes.*

Group VI.—Leaflets elongate. Leaf-sheaths flagelliferous. Primary spathes at first tubular, later more or less split longitudinally and partly laminar. Involucrophorum distinctly pedicellate. Fruiting perianth pedicelliform.

35. *C. travancoricus.*
36. *C. rheedei.*

Group VII.—Leaflets elongate. Leaf-sheaths flagelliferous. Primary spathes tubular, strictly sheathing, not split or lacerate. Involucrophorum distinctly pedicellate. Fruiting perianth pedicelliform. Seed with deeply ruminate albumen.

37. *C. huegelianus.*
38. *C. gamblei.*

Group VIII.—Leaflets elongate and narrow. Leaf-sheaths flagelliferous. Primary spathes strictly sheathing. Involucrophorum in the female spikelets not pedicelliform. Fruiting perianth pedicelliform. Seed deeply ruminated.

39. *C. gracilis.*
40. *C. melanacanthus.*

B.—LEAVES DISTINCTLY CIRRIFEROUS.

Group IX.—Leaf-sheaths not flagelliferous. Spadix not flagelliferous at its apex, usually shorter than the leaves. Primary spathes elongate-tubular, closely sheathing. Male spadix ultra-decompound. Female spadix simply decompound, differing considerably from the male one. Male and female spikelets stalked or inserted at the base of their respective spathes by means of a distinct pedicel. Fruiting perianth explanate. Seed with ruminate or equable albumen.

41. *C. zeylanicus.*
42. *C. ovoideus.*
43. *C. andamanicus.*

Group X.—Leaf-sheaths not flagelliferous. Spadices usually shorter than the leaves, not or slightly flagelliferous at the apex. Spikelets not stalked, inserted near the mouth of their respective spathes. Fruiting perianth pedicelliform or almost explanate. Seed with more or less superficial intrusions of the integument or distinctly ruminate; embryo basilar or slightly shifted to one side.

44. *C. palustris.*
45. *C. latifolius.*
46. *C. doriæi.*
47. *C. polydesmus.*
48. *C. khasianus.*
49. *C. nambariensis.*
50. *C. inermis.*
51. *C. unifarius.*

1. *CALAMUS ERECTUS*, Roxb. Fl. Ind. III, 774; Mart. Hist. Nat. Palm. III, IIH.; Griff. in Calc. Journ. Nat. Hist. V, 35, and Palms Brit. Ind. 43, Pl. CXC, A. f. i. (as *C. acanthospathus*); Kurz in Journ. Asiat. Soc. Beng. XLIII, Pl. 2,209, Pl. XXIII and XIV (excl. *C. longisetus*, Griff.), and For. Fl. Brit. Bur. II, 516, and Rep. Veg. Pegu 90; Hook. f. Fl. Brit. Ind. VI, 439 (excl. *C. schizospathus*); Becc. in Rec. Bot. Surv. Ind. II, 197, and Ann. Roy. Bot. Gar., Calcutta, XI, 121.—*C. macrocarpus*, Griff. in Mart. Hist. Nat. Palm. III, 333, t. 176, f. X, et t. ZXVIII, f. XXIV; Griff. Palms Brit. Ind. 40, Pl. CLXXXVI, A. f. I-II.—*C. erectus macrocarpus*, Becc. in Hook. Fl. Brit. Ind. VI, 439.—*C. collinus*, Griff. in Calc. Journ. Nat. Hist. V, 31, and Palms Brit. Ind. 39 (*excl. descr. fol.*) t. CLXXXV (*spadix tantum*); Mart. Hist. Nat. Palm III, 332.—*C. erectus*, var. *collina* Becc. in Hook. f. Fl. Brit. Ind. VI, 439.

NAMES.—Kadam bet (Beng.), Thaing (Burm.), Sun-gutta (in Sylhet).

DESCRIPTION.—Stem erect, robust, with a crown of large leaves. Ochrea very large, divided into two large hispid auricles. Leaves 3-5 m. long. Leaflets very numerous, equidistant, elongate-ensiform, green on both surfaces, mid-rib sparingly bristly, secondary nerves naked on both surfaces. Leaf-rhachis armed beneath with long straight spines. Spadix not very shortly flagelliferous at its apex (fig. 6). Primary spathes loosely sheathing, speedily lacerated

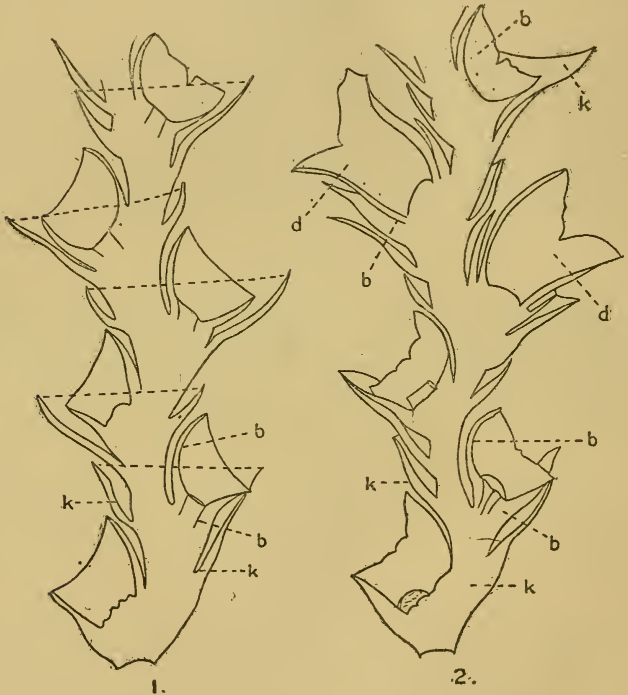


FIG. 6.—*Calamus erectus*.

1. Outline of right hand figure to show the relative position of the spathels (*k*) and of involucre (*b*). The dotted line completes that portion of the margin of the spathel which is not seen in the right hand figure.
2. Portion of a male spikelet in longitudinal section. The involucres (*b*) are half immersed in the spathels (*k*).
   In the upper part is the calyx (*d*) of two flowers still attached to their involucre.

Enlarged 6 diam. (From Beccari).

and marcescent. Fr. 3-4 cm. long ellipsoid. Seed oblong or ovoid, circular in transverse section. Embryo basilar, eccentric (fig. 7).

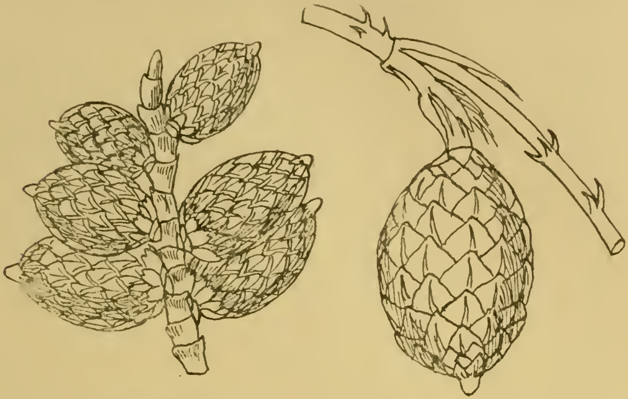


FIG. 7.—*Calamus erectus.*
Left : Top part of branch of spadix.
Right : Part of fruiting spadix with one fruit (After Griffith).

HABITAT.—Sylhet, Khasia Hills, Upper Assam, Chittagong.

USES.—In Sylhet the poorer natives use the seeds as a substitute for that of *Areca* (Roxb.).

CALAMUS ERECTUS, Roxb. var. *schizospathus*, Becc. in Ann. Roy. Bot. Gard. Calc., XI, 125.—*C. schizospathus*, Griff. in Calc. Journ. Nat. Hist. V, 32 ; Palms Brit. Ind. 41, Pl. CLXXXVII ; Mart. Hist. Nat. Palm. III, 332 ; T. Anders. in Journ. Linn. Soc. XI (1869), 71 ; Gamble Man. Ind. Timb. 423 ; Becc. in Rec. Bot. Surv. Ind. II, 197.—*C. erectus*, Becc. (*partim*) in Hook. f. Fl. Brit. Ind. VI, 438.

NAMES.—Reem (Lepchas), Phekri bet (Sikkim).

DESCRIPTION.—Leaflets with a secondary nerve on each side of the mid-rib, sparingly bristly beneath and sometimes also above. Male flower with the calyx half (not almost entirely) projecting from the involucres.

HABITAT.—Sikkim.

USES.—According to Gamble the stem is about 5 cm. in diameter with hard wood and closely packed fibro-vascular bundles ; the canes, however, are useless.

CALAMUS ERECTUS, Roxb. var. *birmannicus*, Becc. in Rec. Bot. Surv. Ind. II, 197, and Ann. Roy. Bot. Gard. Calc. XI, 70 and 126.

DESCRIPTION.—Female spadix more slender than in the type, produced into a rather long (75 cm.) flagelliform aculeate appendix. Fruit smaller.

HABITAT.—Burma, on the Karen mountains at 1,000—1,200 m.

2. *CALAMUS FLAGELLUM*, Griff. in Mart. Hist. Nat. Palm. III, 333. Pl. 176, f. IX ; Palms Brit. Ind. 48 ; T. Anders. in Journ. Linn. Soc.

XI (1869), 8; Gamble Man. Ind. Timb. 423; Hook. Fl. Brit. Ind. VI, 439; Becc. in Rec. Bot. Surv. Ind. II, 197, and Ann. Roy. Bot. Gard. Calc. XI, 70, 127.—*C. jenkinsianus*, Griff. Palms Brit. Ind. 40, Pl. CLXXXVI A. f. iii (non pag. 89).—*C. polygamus*, Roxb. Fl. Ind. III, 780?

Names.—Rabi Bet (Nepal), Reem (Lepchas), Nagagola Bet (Assam).

Description.—Scandent and robust. Leaf-sheaths with very unequal never seriate spines. Ochrea marcescent. Leaf-sheath-flagella up to 6-7 m. long. Leaves very large. Leaflets numerous, equidistant, green on both surfaces, broadly ensiform, strongly unicostate; the mid-rib with a few subspiny bristles, secondary nerves naked on both surfaces. Leaf-rhachis clawed on the back. Spadix elongate, flagelliform. Primary spathes tubular, closely sheathing, lacerated at apex. Fr. about 3 cm. long, broadly ovoid. Seed ovoid, circular in transverse section; embryo basilar.

Habitat.—N.-E. India, Assam, Khasia Hills, Eastern Bengal, Sikkim.

Uses.—The fruit is edible (Hooker). The canes are soft and useless (Anders.).

CALAMUS FLAGELLUM, Griff. var. *karinensis*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 70, 129.

Description.—Leaf-sheaths armed with very unequal spines, some being large and others small and seriate.

Habitat.—Burma, Karen mountains at 1,200-1,400 m.

3. *CALAMUS ARBORESCENS*, Griff. in Calc. Journ. Nat. Hist. V, 33, and Palms Brit. Ind. 42, t. CLXXXVIII A. B. C; Mart. Hist. Nat. Palm. III, 332; Miq. Fl. Ind. Bat. III, 113; Kurz in Journ. Asiat. Soc. Beng. XLIII, Pt. II, 208, t. XXII, and For. Fl Brit. Burm. II, 516, and Rep. Veg. Pegu (1875), 90; Gamble Man Ind. Timb. 423; Hook. f. Fl. Brit. Ind. VI, 439; Becc. in Rec. Bot. Surv. Ind. II, 198, and Ann. Roy. Bot. Gard. Calc. XI, 70, 131.—*C. hostilis*, Hort. Calc.

Names.—Thanoung, Danoung, Kyenbankyen, Damon, Danoung Thain (Burm.).

Description.—Cæspitose. Stem erect, robust, 4-6 m. high. Leaves large. Leaf-sheaths, petiole, and leaf-rhachis armed with large, laminar, almost black, shining, seriate spines. Leaflets equidistant, broadly ensiform, green above, white underneath. Male spadix elongate, pendulous. Primary spathes tubular, rather closely sheathing, lacerated and fibrous in their upper part, armed only with straight black spiculæ and never with hooked spines or claws. Secondary spathes clavate, sub-inflated and usually lacerated and blackened. Spikelets large with flatly bifarious flowers.

Habitat.—Pegu in Burma, common and gregarious in evergreen forests.

4. *CALAMUS LONGISETUS*, Griff. in Calc. Journ. Nat. Hist V, 36, and Palms Brit. Ind. 44, t. CLXXXIX A. B.; Mart. Hist. Nat. Palm. III, 333; Miq. Fl. Ind. Bat. III, 114; Hook. Fl. Brit. Ind. VI, 440; Becc. in

Rec. Bot. Surv. Ind. II, 199, Ann. Roy. Bot. Gard, Calc. XI, 71, 134.—*C. tigrinus*, Kurz in Jour. As. Soc. Beng. XLIII, Pt. II (1874), 211, t. XXV and For. Fl. Brit. Burm. II, 519.

Names.—Leme (Burm.), Umdah, Am (Andam.).

Description.—Scandent. Leaves up to 3-4 m. long. Leaflets not equidistant often in groups of 2-3, almost equidistant towards the summit, green on both surfaces, ensiform, unicostate, mid-rib remotely spinulose above with some very long blackish bristles beneath. Male and female spadices simply decompound. Primary spathes elongate-tubular, lacerate in their upper part; secondary ones slightly inflated. Female spikelets very large with flatly bifarious flowers. Fr. ellipsoid-ovate, over 3 cm. long, transversely mottled like a tiger skin. Seed oblong, 5-7 costate.

Habitat.—Pegu, Andamans.

Uses.—The natives of the Andamans eat the fruit cooked. The leaflets are employed for coverings.

5. *CALAMUS THWAITESII*, Becc. in Hook. f. Fl. Brit. Ind. VI, 441; Rec. Bot. Surv. Ind. II, 199, Ann. Roy. Bot. Gard. Calc. XI, 71, 137; Trimen Fl. Ceylon IV, 330; Talb. Trees Bomb. ed. 2,344 (*partim*); Brandis Ind. Trees (1906), 652 (*partim*); Cooke Fl. Bomb. Presid. II, 807 (*partim*). —*C. longisetus*, Thw. Enum. Plant. Zeyl. 330. (non Griff.)

Description.—Leaves large. Leaflets irregularly fascicled, broadly ensiform, green on both surfaces, unicostate. Mid-rib with black, short subspiny bristles on both surfaces; secondary nerves naked. Male and female spadices simply decompound, flagelliform, with the axial parts between the inflorescences very elongate and strongly clawed; primary spathes very long, narrow, thinly coriaceous, closely sheathing, lacerated near the mouth. Male and female spikelets very elongate. Fr. ellipsoid or obovate-eliptic, suddenly contracted into a conic beak, about 2½ cm. long; scales in 12 series broadly channelled along the middle. Albumen equable; embryo basal.

Habitat.—Ceylon. Moist low country, below 2,000 ft., rather rare, Kalutara, Kandy, Hantane, Rambukkama, Kurnegala.

Flowers.—February to May.

CALAMUS THWAITESII, Becc, var. *canaranus*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 71, 138.; Cooke Fl. Bom. Pres. II, 807 (*partim*).

Name.—Handibet (Kanara).

Description.—Male spikelets with more numerous and more approximate flowers. Seeds more flattened than in the type specimen.

Habitat.—Kanara, common in the evergreen forests at the foot of the Nilkund Ghat.

Flowers.—February to March.

6. *CALAMUS LEPTOSPADIX*, Griff. in Calc. Journ. Nat. Hist. V, 49, Palms Brit. Ind. 60, t. CXCIV A.B.C; Mart. Hist. Nat. Palm. III, 339.

t. 175, f. II, et t. ZXVIII, f. XIII ; T. Anders. Journ. Linn. Soc. XI, 8 ; Gamble Man. Ind. Tim. 423 ; Hook. f. Fl Brit. Ind. VI, 441 ; Becc. in Rec. Bot. Surv. Ind. II, 199, Ann. Bot. Gard. Calc. XI, 72, 142.

NAMES.—Lat (Lepcha), Dangri Bet (Nepal), Rani, Rabi Bet (Kurseong).

DESCRIPTION.—Scandent, forming tangled thickets; stems slender; foliage feathery. Leaves over 1 m. long. Leaflets numerous, approximate, regularly equidistant, linear-ensiform, 20-30 cm. long, 3-costate. Male and female spadices simply decompound and similar, long and slender. Partial inflorescences not many, very distant, strict, slender, 20-40 cm. long with 10-20 appressed spikelets on each side. Primary spathes very narrow, cylindrical, closely sheathing. Male spikelets scorpioid, 1-2 cm. long. Fr. globose or globose-ovoid, about 1 cm. in diameter (fig. 8).

HABITAT.—N.-E. India, Khasia Hills, Naga Hills, Sikkim.

Was found in flower and fruit in November.

Illustration : Plate CIII.

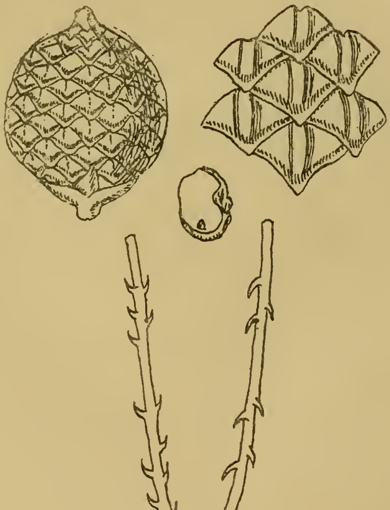
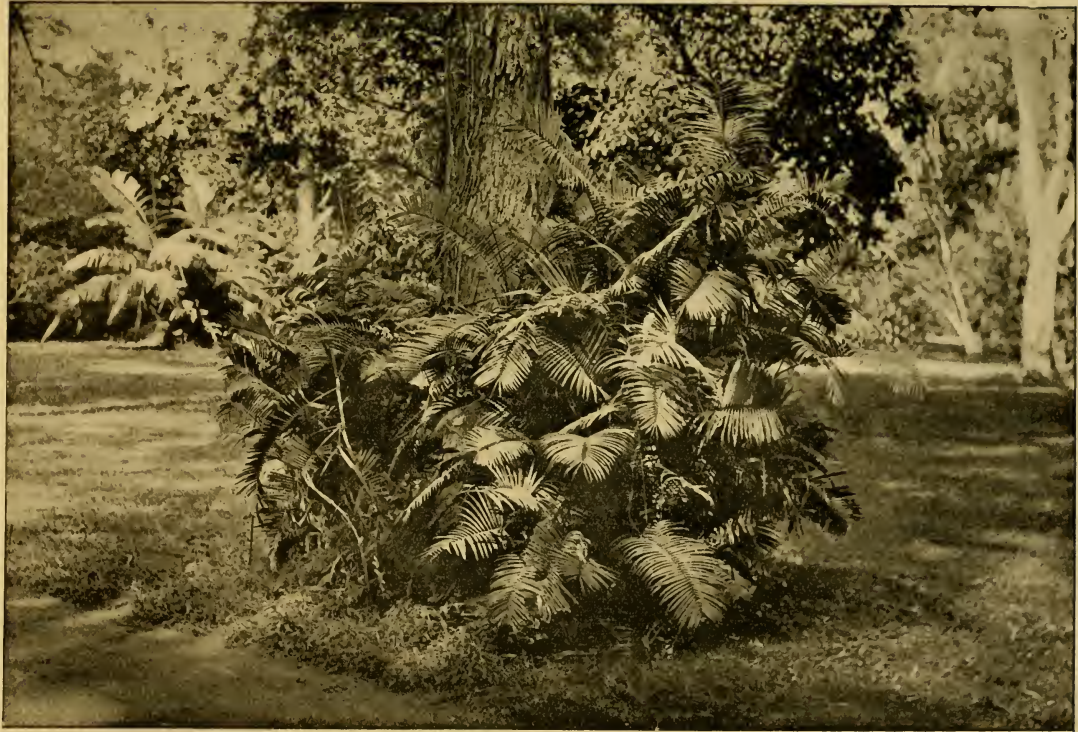


FIG. 8.—*Calamus leptospadix.*
Upper left: Fruit. Enlarged more than two diam.
Upper right : Scales of fruit. Magnified.
Central : Longitudinal section of seed (natural size).
Lower : Part of flagellum of female spadix (After Griffith).



Calamus leptospadix, Griff.

7. *CALAMUS DILACERATUS*, **Becc. in Rec. Bot. Surv. Ind. II, 198; Ann. Roy. Bot. Gard. Calc. XI, 72, 144.**

DESCRIPTION.—Tufted, probably not scandent. Female spadix erect, paniculate. Primary spathes short, membranous, dry, lacerate, armed with fine black spicules; secondary spathes tubular-infundibuliform, dry, thin in texture and much lacerate. Female spikelets with a pedicellar portion 1-1½ cm. long. Fruiting perianth of 6 spreading, equal, lanceolate parts. Fr. small, ovate, 12 mm. long. Seed subglobose with an even surface.

HABITAT.—Nicobar Islands.

8. *CALAMUS PACHYSTEMONUS*, **Thw. Enum. Pl. Zeyl. Addenda, 431; Hook. Fl. Brit. Ind. VI, 422; Becc. in Rec. Bot. Surv. Ind. II, 201; Ann. Roy. Bot. Gard. Calc. 74, 165.—*C. gracilis*, Thw. l. c. 330 (*non* Roxb.). Trimen Fl. Ceyl. IV, 333.**

DESCRIPTION.—Stem slender, scandent; sheaths sparingly tubercled and armed with small flattened pale spines. Leaves 1-2 feet long, pinnate, upper bifoliate; petiole short, slender; rhachis armed with solitary, stout, recurved spines, rhachis about 3-7 inches long, not flagelliferous; leaflets 4-7, irregularly disposed, 5-12 inches long and ½-2½ inches broad, oval, subacute, or obtusely accuminate, 3-5-veined, margins and midrib beneath smooth, cross-venules distinct, upper pair sometimes connate with a spinous rhachis. Spathes funnel-shaped, truncate, cuspidate, armed with small prickles; spathels and spathellules cupular or patelliform. Spadix very long, slender, decompound, branches few, spikes many, alternate, ¼-⅓ inch long, crowded, scorpioidly recurved. Male flowers in many series, ⅙ inch long, linear, curved; calyx cupular, striate, lobes short, obtuse; petals twice as long, linear-oblong, acute, striate, connate in a column at the base; filaments thickened at the base, then subulate, tip not inflected. Fruit unknown.

HABITAT.—Ceylon. Moist low country below 1,000 feet, rare. Kukl, Korale, Kalutara, Galle.

FLOWERS.—In November and December.

9. *CALAMUS DIGITATUS*, **Becc. in Hook. f. Fl. Brit. Ind. VI, 442; Becc. in Rec. Bot. Surv. Ind. II, 201; Ann. Roy. Bot. Gard. Calc. 74, 166.—*C. pachystemonus*, Thw. Enum. Pl. Zeyl. 431 (*partim*).**

NAME.—Kukula-wel (Singh.).

DESCRIPTION.—Stem very slender, scandent; sheath not flagelliferous (?), copiously beset with long and short, strong, straight, flat spines and conical shorter ones, mouth with a rather large ochrea; petiole 6-8 inches long, slender; rhachis furfuraceous, unarmed, or with a few distant, recurved, large or small spines. Leaves digitately 2-4-foliate; leaflets 8-12 inches long and 1-3 inches broad, oblanceolate, cuspidately acuminate, 3-7-veined, base scurfy beneath, margins and veins smooth, upper pair sometimes confluent with a spinous rhachis for half their length. Lower spathe elongate, cylindric, unarmed, upper very slender, mouth truncate, entire, spadix very long, slender, decompound, very sparingly spinous, branches distant; spikes very many, $\frac{1}{2}$-1 inch long, spathels short, patelliform, imbricate. Male flowers $\frac{1}{8}$ inch long; calyx tubular, striate, lobes short; petals twice as long or more, narrow, straight or falcately curved; connate at the base; filaments very short, conical, tip subulate, straight. Fr. seated on the slightly enlarged perianth, globose, $\frac{1}{3}$ inch in diameter, pale yellow; beak very small; scales 6-7 in a vertical series, very broad with scarious brown margins and an obscure channel in the middle; endosperm subruminate; embryo basilar.

HABITAT.—Ceylon. Moist low country below 1,000 feet, rather rare. Reigaur and Pasdun Korales, Hiniduma, Galle.—Endemic.

FLOWERS.—In March.

10. *CALAMUS RADIATUS*, Thw. Enum. Pl. Zeyl. Addenda, 431 (1864); Hooker f. Fl. Br. Ind. VI, 442; Trim. Fl. Ceyl. IV, 333; Becc. in Rec. Bot. Surv. Ind. II, 20; Ann. Roy. Bot. Gard. Calc. XI, 75, 168.

NAME.—Kukula-wel (Singh.).

Stem very slender, scandent; sheaths flagelliferous, densely armed with short acicular spines which are free or are connate below in transverse ridges mixed with long bristles, upper transversely rugose. Leaves radiately 6-8-foliolate; petiole 2-4 inches long; rhachis rather slender, bearing small scattered recurved spines. Leaflets 8-12 inches long and $\frac{2}{3}$ inch broad, linear acuminate, thin, 3-veined, midrib beneath and margins quite smooth. Spathes few, very long, clavately funnel-shaped, cuspidate. Spadix polygamo-dioecious, very long, slender, decompound, armed with small recurved spines; primary branches 2-6, 2-3 feet long; spikes $\frac{1}{2}$-$\frac{2}{3}$ inch long, rather distant, reflexed, 3-15-flowered, naked. Spathels and spathellules cup-shaped. Male flowers: Calyx short, cylindric, striate; petals much longer, connate below in a short tube; filaments conical, tip subulate, straight; pistillode oblong, 3-fid. Female flowers $\frac{1}{10}$ inch long; calyx cupular, lobes broad, acute, striate; petals short, acute, striate. Fruit seated on the slightly enlarged perianth, globose, $\frac{1}{3}$ inch in diameter, shortly beaked; scales about 8 in a vertical series, broadly triangular, dull yellow with narrow red-brown entire margins, and an obscure median channel; endosperm ruminate; embryo basilar.

HABITAT.—Ceylon. Moist low country below 1,000 feet, rather common, Hiniduma, Hewesse, Kalutara.—Endemic.

FLOWERS.—In February and March.

(To be continued.)

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THE RAPTORES OF THE PUNJAB.

BY

C. H. DONALD, F. Z. S.

(*With 2 Plates.*)

The writer has been asked, frequently, to write a small pamphlet dealing with the Birds of Prey of the Punjab, in simple language, and in such a way, if possible, as will save the layman from wading through pages of printed matter couched more or less in technical language, to arrive at the species of any particular specimen.

In a Province, rich in Raptores, it is strange how very little is really known about them and since even a scanty knowledge of the birds and beasts around one, materially enhance the joys of camp life, many more people would take up the subject, if it was possible to do so, without taking up too much of one's time.

The Birds of Prey lend themselves particularly in this respect and considering the total number of species in the Province is under three score, it is by no means a comprehensive subject, and I do not think it is an exaggeration to state that quite 60 per centum of them can be recognised high up in the air, and very nearly the same percentage could be identified by touch alone, blindfolded, from skins of normal specimens, with a little practice.

There are now numbers of books which make the study of our feathered friends a pleasure, but very few, unfortunately, do more than just touch on the Birds of Prey, and yet they amply repay a little trouble on their behalf.

In this paper, it is not the intention of the writer to go into minute details, and colouring will not be described at all, except in a very general way, or where some species displays some peculiar characteristic in that respect, which is also a constant feature.

Most Raptores change their entire dress from the nestling to the adult stage and hence colouration is a broken reed to depend on.

It will be seen from the keys appended that there are other and much more reliable factors than colouration to go on, for the identification of species.

From the keys here given, it will be possible not only to place any given specimen in its proper genus. by merely looking at its legs, head, beak and wings but in about 90 per cent. of cases, to also name its species. There are some half a dozen species which will need a closer study of their characteristics than will be found in this paper, but since the search will then only be confined to one of two species in each case, it reduces one's work to a minimum.

The actual details and measurements here given lay no claim to originality. They are all to be found in various books of reference, with one or two additions which the writer has noted for himself, as rare exceptions, but the method of bringing out the characteristics of a genus or species, is, I believe, original, and if not on scientific lines, it at least lays claim to simplification of identification, which is the chief object of this paper.

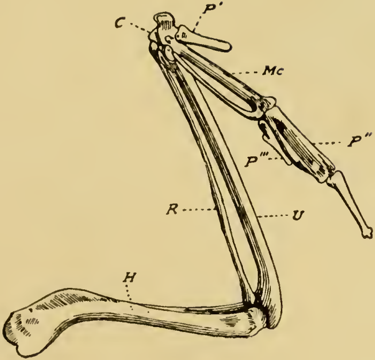
The details of the keys in most cases have been taken from Blanford's Fauna of British India, Vol. III., which cannot be improved upon and in the few instances in which the specimen to be identified is not discoverable by these keys, a further reference to the above mentioned Volume will dispel all doubt.

I have already said that the Birds of Prey are but little known, as a general rule, and to give but a couple of instances will suffice to show how easy it is to go wrong from descriptions, when colour is depended on too much. Not many years ago, the writer saw a very fine specimen of a Golden Eagle, in its first plumage, in an up-to-date museum marked "*Aquila heliaca*, the Imperial Eagle" and a legend beneath informed the visitor that "this bird sometimes catches chikor"!

On another occasion a Golden Eagle in its transition stage of plumage was the innocent cause of a controversy which lasted for several months, and the specimen was finally sent home for identification. The reason for this is not far to seek. In its first plumage, the Golden Eagle is marked very like an Imperial Eagle in its adult plumage. Both are a very deep brown, almost black generally, both have light brown or buff lanceolate feathers on the head and neck, both have a lot of white on the tail and a white patch in the centre of each wing and a large female Imperial would be very nearly as big as a small male Golden. But here the similarity ends. To any person acquainted with the habits of the two birds, they are as the Poles apart. One is a mighty hunter with a very large and powerful foot and claws, an easy graceful flight during which he holds his wings well above his back and shows a large expanse of chest, whereas the other is nothing more or less than as Mr. Hume has very aptly called him, a " great hulking kite".

He is no more capable of catching a chikor except a wounded or a tame bird, than is the Lammergeyer capable of pulling down an ibex or a " ghoorel", as he has been accredited with doing in all seriousness. One look at the comparatively weak foot and small talons precludes any such possibility. In flight the true Eagles, with the exception of the Golden Eagle, very much resemble the Vultures, except that they appear very much lighter on the wing and show a little more tail, protruding beyond the line of the wing.

As a rule when the Vultures are soaring, their wings appear to be broader than the Eagles and the tail when spread, as it frequently is, forms almost a continuous line with the edges of the wings. I say *almost* a line, as it is not exactly a continuous one and it looks



H = humerus = arm bone in a human.
R = radius, U = ulna } = fore arm " "
C = carpus = wrist " "
Mc = metacarpus = palm " "
P' = thumb of the hand " "
P'', P''' } = phalanges of the fingers " "

The wing feathers.

Primaries	always 11 in Birds of Prey, grow from the bones of the hand, *i.e.*, on the finger joints and metacarpus.
Secondaries	shorter and softer than the primaries, arise from the fore arm, on the posterior side of the ulna.
Tertiaries	grow from the end of the fore arm, nearest the body.

WING OF VULTURE.

THE RAPTORES OF THE PUNJAB.

as though a small piece had been cut out on either side, where the tail feathers touch the tertiary wing quills, and the tail itself projects just the least bit beyond the line of the wings.

I will endeavour to show the difference between the flights of the various genera later on in this paper. It is not too much to say that it is very often easier to identify a bird on the wing than it is, at a casual glance, in the hand.

The nomenclature in every case is the same as that given in the Fauna of Br. India (Blanford) but I have sub-divided the Families and Sub-Families into "Types" and have changed the sequence of the genera as given in the above book, to suit the purposes of my "Types."

To give an example as to how the keys are worked, let us imagine we have got a specimen of some large Raptores which we wish to identify. Look at the following points :—

A. Has it got feathers on its head and neck or only down? Feathers, well it cannot be a Vulture, so we can leave out of count Type "C."

B. Examine next its legs; has it got a feathered tarsus, *i.e.*, does the feathering extend to the base of the toes, back and front? It does, so the specimen must come under Type "D," therefore it must be either a true Eagle, a Lammergeyer, or Hawk Eagle, but which? Next you look at the wing. Fold the wings against the body in the same way as the bird would naturally have them when sitting down and see if the longest primary quills reach to within an inch or less of the tip of the tail. You find they do and that the hind claw (without the toe) is the longest claw. so you straight away eliminate all the Hawk-Eagles and know that your specimen must be a true Eagle and belong to the genus *Aquila.*

You have thus got rid of 24 genera and some 50 species and have now only got 5 species to go through and that will be found as simple as arriving at the genus, and you proceed as follows :—

A. Look at the nostril and see whether it is elliptical or ear-shaped and higher than broad, or if it is round and as broad as high. You find it to be distinctly elliptical and higher than it is broad, so it cannot be that of *A. maculata.*

B. You next measure the length of its tarsus and find it to be just 4″ so you know that it cannot be either an Imperial (*A. heliaca*) or a Tawny (*A. vindhiana*) and must be either a Golden (*A. chrysaëtus*) or a Steppe Eagle (*A. bifasciata*).

C. Having arrived at this conclusion you next look at its foot and claws. A huge foot, in which the claws are capable of meeting round your wrist, and the hind claw well over

2″ in length, round the curve, dispels all further doubt and you know your specimen is undoubtedly a Golden Eagle.

After a very little practice it will not be necessary to go through the process of elimination and the specimen will be placed in its proper genus at the first glance. In the above example it will be seen that the specimen selected is of a Type that contained other genera with very similar characteristics, so we will try another and a simpler one.

A very large bird, with tarsi feathered and a *beard of stiff bristles* depending from the chin. Straight off you have the genus *Gypaëtus* and since there is only one species representing this genus, your specimen is *Gypaëtus barbatus*, the Lammergeyer.

By placing all the different genera with a common characteristic into one Type, it reduces one's search from some 55 to 14 species, by merely looking at the head, feet or beak, as the largest Type, *viz.*:—" G," has 14 species, whereas 3 have only one species each, and having found your Type you know exactly how many genera and species have been automatically eliminated and how many remain.

I now proceed to give the keys for, (*a*) the Types and (*b*) for the genera and species.

THE BIRDS OF PREY DIVIDED INTO "TYPES."

ORDER *ACCIPITRES.*

Families .. .. .. Pandionidæ, Vulturidæ, Falconidæ.
Sub Families .. .. *Gypaëtinæ, Falconinæ.*
Types .. .. A, B, C, D, E, F, G, H.

Genera and Species.

Type A. . .Genus	Pandion	Species	*P. haliætus*, The Osprey.
Type B. . .Genera	Vultur	..	*V. monachus*, The Cinereous Vulture.
	Otogyps	,,	*O. calvus*, The Black Vulture.
	Gyps	..	*G. fulvus*, The Griffon Vulture. *G. himalayensis*, The Himalayan Griffon. *G. indicus*, The Indian Long-billed Vulture. *G. tenuirostris*, Himalayan Long-billed Vulture.
	Pseudogyps	..	*P. bengalensis*, Indian White-backed Vulture.
	Neophron	..	*N. ginginianus*, Smaller White Scavenger Vulture. *N. percnopterus*, Large White Scavenger Vulture.

Type C.	Genus	Gypaëtus	Species.	*G. barbatus*, The Lammergeyer.
Type D.	Genera	Aquila	,,	*A. chrysaëtus*, The Golden Eagle.
				A. heliaca, The Imperial Eagle.
				A. bifasciata, The Steppe Eagle.
				A vindhiana, The Tawny Eagle.
				A. maculata, The Large Spotted Eagle.
		Hieraëtus	,,	*H. fasciatus*, The Bonelli's Eagle.
				H. pennatus, The Booted Eagle.
		Ictinaëtus	,,	*I. malayensis*, The Black Eagle.
		Spizaëtus	,,	*S. limnaëtus*, The Changeable Hawk-Eagle.
				S. nepalensis, Hodgson's Hawk-Eagle.
Type E.	Genus	Archibuteo	,,	*A. hemiptilopus*, Himalayan Rough-legged Buzzard.
Type F.	Genera	Elanus	,,	*E. cæruleus*, The Black-winged Kite.
		Milvus	,,	*M. govinda*, Common Pariah Kite.
				M. melanotis, The Large Indian Kite.
				M. migrans, The Black Kite.
		Haliastur	,,	*H. indus*, The Brahminy Kite.
		Pernis	,,	*P. cristatus*, The Crested Honey Buzzard.
		Buteo	,,	*B. ferox*, The Long-legged Buzzard.
				B. leucocephalus, The Upland Buzzard.
				B. desertorum, The Common Buzzard.
Type G.	Genera	Circaëtus	,,	*C. gallicus*, The Short-toed Eagle.
		Spilornis	,,	*S. cheela*, The Crested Serpent Eagle.
		Butastur	,,	*B. teesa*, The White-eyed Buzzard Eagle.
		Haliaëtus	,,	*H. leucoryphus*, Pallas's Fishing Eagle.
				H. albicilla, The White-tailed Sea Eagle.
		Polioaëtus	,,	*P ichythaëtus*, The Large Grey-headed Fishing Eagle.
				P. humilis, Hodgson's Fishing Eagle.
		Circus	,,	*C. macrurus*, The Pale Harrier.

Type G. . . Genera	CIRCUS	Species.	*C. cyaneus*, The Hen Harrier. *C. æruginosus*, The Marsh Harrier.
	ASTUR	,,	*A. palumbarius*, The Goshawk. *A. badius*, The Shikra.
	ACCIPITER	,,	*Ac. nisus*, The Sparrow-Hawk. *Ac. virgatus*, The Besra Sparrow-Hawk.
Type H. . . Genera	FALCO	,,	*F. peregrinus*, The Peregrine Falcon. *F. peregrinator*, The Shahin Falcon. *F. barbarus*, The Barbary Falcon. *F. jugger*, The Laggar Falcon. *F. cherug*, The Saker Falcon. *F. milvipes*, The Shanghar Falcon. *F. subbuteo*, The Hobby. *F. severus*, The Indian Hobby.
	ÆSALON	,,	*Æ. regulus*, The Merlin. *Æ. chicquera*, The Turumti or Red-headed Merlin.
	TINNUNCULUS	,,	*T. alaudarius*, The Kestrel.

Key to the Types of Raptores.

Type.	*Characteristics.*
A. Size medium . .	a. Head feathered; b. tarsi naked; c. outer toe reversible; d. no aftershaft to contour feathers.
B. Size very large	a. Head feathered; b. tarsus feathered; e. beard of rough bristles depending from the chin.
C. Very large to medium	a. Head naked or covered with down: b. tarsus naked.
D. Do. do.	a. Head feathered; b. tarsus feathered to the toes back and front.
E. Large . .	a. Head feathered; b. tarsus feathered to the toes in front only, naked behind.
F. Medium to small	a. Head feathered; b. tarsi feathered, in front, for about half its length, or more, naked behind.
G. Large to small	a. Head feathered; b. tarsi feathered, in front, for less than half its length, or only at the base, naked behind.
H. Small . .	a. and b. As for F. (f.) a sharp pointed tooth on the cutting edge of the upper mandible.

Key to the Genera of the Raptores.

In the Key to the *Genera* of the Types, letters from a to r have been used to denote various peculiarities merely to save repetition.

Through this Key—

a. refers to peculiarity of nostril
b. ,, ,, ,, ,, tail
c. ,, ,, ,, ,, neck
d. ,, ,, ,, ,, primaries with reference to secondaries
e. ,, ,, ,, ,, claws
f. ,, ,, ,, ,, primaries with reference to tail
g. ,, ,, ,, ,, crest
h. ,, ,, ,, ,, tarsus

and so on. For instance, in the case of the genus *Hieraëtus* in which the primaries exceed the secondaries by more than length of tarsus the claws are much curved, hind claw longest (as in the case of *Aquila*), instead of repeating the whole characteristic, I merely say "d and e as in *Aquila*" under which genus it has already been given.

The same letter, wherever it occurs, always applies to the same characteristic in the Key to the genera.

Type.	*Genus.*	*Size.*	*Characteristics.*
A.	Pandion	.. Medium	.. The same as for the Type.
B.	Gypaëtus	.. Very large	.. The same as for the Type.
C.	Vultur	.. ,,	.. a. Nostril round; b. tail of 12 feathers.
,,	Otogyps	.. ,,	.. a. and b. As for *Vultur*; c. fleshy wattle on each side of the neck.
,,	Gyps	.. ,,	.. a. Nostril a narrow vertical slit; b. tail of 14 feathers.
,,	Pseudogyps	.. ,,	.. a. As for *Gyps*; b. tail of 12 feathers.
,,	Neophron	.. Medium	.. a. Nostril a narrow horizontal slit.
D.	Aquila	.. Large to medium	d. Primaries exceeding secondaries by more than length of tarsus; e. claws much curved, hind claw longest; f. primaries reaching to the tip of tail in closed wing, or very nearly.
,,	Hieraëtus	.. ,,	.. d. and e. As for *Aquila;* f. primaries not reaching to within a couple of inches of tip of tail.
,,	Ictinaëtus	.. Large	.. d. As for *Aquila*; e. claws but little curved, inner longer than hind claw.
,,	Spizaëtus	.. Medium	.. d. Primaries exceeding the secondaries by less than length of tarsus; e. as for *Aquila*; f. primaries only reaching to just over half way down the tail in closed wing; g. an occipital crest present.

Type.	*Genus.*	*Species.*	*Characteristics.*
E.	Archibuteo	Large	The same as for the Type.
F.	Elanus	Very small	h. Tarsus very short, under 1½″ in length.
,,	Milvus	Medium	h. Tarsus over 2″, scutellated in *front*, not behind; i. tail forked; j. colour dark brown.
,,	Haliastur	,,	h. As for *Milvus*; i. tail rounded; j. colour in adults maroon above, white below.
,,	Buteo	,,	h. Tarsus from 2·75″ to 3·75″ in length, with transverse shields *behind*.
,,	Pernis	,,	k. Bill compressed and weak; l. lores and sides of head covered with small scale like feathers.
G.	Haliaëtus	Large	h. Tarsus with some scutellæ broader than high, over 4″ in length; m. claws grooved beneath.
,,	Polioaëtus	Medium	h. As for *Haliaëtus*, but under 4″; m. claws rounded beneath, outer toe partially reversible.
,,	Circaëtus	Large	h. Tarsus reticulated throughout, no scutellæ broader than high; n. no crest.
,,	Spilornis	Medium	h. As for *Circaëtus*; n. broad nuchal crest.
,,	Butastur	Small	h. Scales in front of tarsus larger than those behind, not scutellated behind. Those in front practically the same size from base of tarsus to near the base of mid-toe and not diminishing in size gradually. o. irides white in adults.
,,	Circus	Medium	h. Tarsus with transverse shields in front and smaller polygonal scales behind. The scales in front largest near the top end and diminishing in size lower down, where they become gradually absorbed in the reticulation near base of mid-toe. o. irides yellow or light brown.
,,	Astur	Medium to small	h. Tarsus scutellated behind and in front: p. bill from gape 2/3rd to ¾ of mid-toe without claw.
,,	Accipiter	Small	h. As for *Astur*; p. bill from gape about ½ mid-toe without claw.
H.	Falco	Medium to small	q. 2nd quill longest, 1st much longer than 4th; i. tail rounded; r. upper plumage grey or brown.
,,	Æsalon	Small	q. 2nd and 3rd quills longest and subequal, 1st and 4th, also subequal.
,,	Tinnunculus		i. Tail graduated, a difference of 1½″ to 2′ between the middle pair and outer tail feathers a broad dark band on end of tail, the extreme tip white; r. upper plumage reddish.

Key to the Species of the Raptores.

Type.	*Genus.*	*Species.*	*Characteristics.*
A.	Pandion	*P. haliaëtus*	As for genus.
C.	Gypaëtus	*G. barbatus*	As for genus.
B.	Vultur	*V. monachus*	As for genus.
	Otogyps	*O. calvus*	As for genus.
	Gyps	*G. fulvus*	a. Larger, wing 27-31 inches; b. 3rd primary longest; lower plumage with narrow shaft stripes.
	..	*G. himalayensis*	a. As for *G. fulvus*; b. 4th primary longest; lower plumage with broad shaft stripes.
	..	*G. indicus*	a. Smaller, wing 22-25·5″; b. crown of head with scattered hairs.
	..	*G. tenuirostris*	a. As for *G. indicus*; b. crown of head naked.
	Neophron	*N. ginginianus*	a. Bill yellow in adults; length about 24″.
	,,	*N. percnopterus*	a. Bill dark horny at all ages, length about 26 inches.
D.	Aquila	*A. chrysaëtus*	a. Nostril elliptical, higher than broad; b. tarsus 4″ in length; c. hind claw over 2½″.
	..	*A. heliaca*	a. As for *A. chrysaëtus*; b. tarsus under 4″—3-5″ to 3-85″.
	..	*A. bifasciata*	a. and b. As for *A. chrysaëtus*; c. hind claw well under 2″.
	..	*A. vindhiana*	a. As for *A. chrysaëtus*; b. tarsus 2-75″ to 3-25″.
	,, ..	*A. maculata*	a. Nostril round, as broad as high.
	Hieraetus	*H. fasciatus*	a. Much larger, wing 19-21″.
	,, ..	*H. pennatus*	a. Smaller, wing 14-16½″.
	Ictinaëtus	*I. malayensis*	As for genus.
	Spizaëtus	*S. limnaëtus*	a. Feathering of tarsus does not extend to division of toes; b. crest rudimentary.
	,,	*S. nepalensis*	a. Feathering of tarsus extends to basal portion of mid-toe; b. crest 3′ to 4″.
	Archibuteo	*A. hemiptilopus*	As for genus.
E.	Elanus	*E. cæruleus*	As for genus.
F.	Milvus	*M. govinda*	a. Head tawny or rufous with black streaks in adults; b. length 24″ or under.
	,,	*M. melanotis*	a. As for *M. govinda*; b. length about 25″ or over.
	,,	*M. migrans* (rare).	a. Head whitish with black streaks; b. length about 23″.
	Haliastur	*H. indus*	As for genus.
	Pernis	*P. cristatus*	As for genus.
	Buteo	*B. ferox*	a. Wing over 16″; b. tarsus half feathered, naked part in front scutellate.

Type.	Genus.	Species.	Characteristics.
F.	Buteo	B. leucocephalus	a. Wing over 16″; b. tarsus 2/3rd feathered, naked part in front reticulated.
	,,	B. desertorum	a. Wing under 16″.
G.	Circætus	C. gallicus	As for genus.
	Spilornis	S. cheela	As for genus.
	Butastur	B. teesa	As for genus.
	Haliaëtus	H. leucoryphus	a. Tarsus 4″-4·2″; b. tail about 12″, rounded, the outer feathers not much shorter than middle pair, white band across it, about 3″ from the end; c. feet dirty white.
	,,	H. albicilla	a. Tarsus 4·5″; b. tail about 13″, wedge shaped, middle feathers considerably longer than the outer pair, white except at the extreme tip; c. feet yellow.
	Polioaëtus	P. ichthyaëtus	a. Basal ¾ of all tail feathers white, in adults, mottled in young; b. length about 27″-29″, tarsus 3·7.″
	,,	P. humilis	a. Middle tail feathers brown throughout; b. length about 25″, tarsus 3.″
	Circus	C. macrurus	a. Outer web of 2nd, 3rd and 4th primaries notched but not of 5th; b. wing 14½″; tarsus under 3″.
	,,	C. cyaneus	a. Outer web of 5th quill notched; wing under 15″, tarsus about 3″.
	,,	C. æruginosus	a. b. Wing over 16″ and tarsus 3½″ about.
	Astur	A. palumbarius	a. Size large, wing 12″ to 15″.
	,,	A. badius	a. Size small, wing 7″ to 9″.
	Accipiter	A. nisus	a. No gular stripe, 5 or 6 dark bars, one terminal, on 4th quill in adults.
	,,	A. virgatus	a. Generally a dark gular stripe; 7 or 8 bars on 4th quill in adults.
H.	Falco	F. peregrinus	a. Length 16″ to 19″; b. 1st primary longer than the 3rd; c. cheek stripe broader than the eye, no nuchal collar; d. crown dark grey, breast very slightly rufous.
	,,	F. peregrinator	a. Length 15″ to 18″; b. and c. as for above; d. crown blackish, breast generally deep rufous.
	,,	F. barbarus	a. Length 15″ to 17″; b. as for above; c. cheek stripe narrow, a buff nuchal collar, head ashy grey or rufous.

Type.	*Genus.*	*Species.*	*Characteristics.*
H.	Falco.	*F. jugger.*	a. 16″ to 18″ length; b. 1st primary subequal to 3rd or shorter; adults not banded above; c. A distinct narrow cheek-stripe, middle tail feathers entirely brown in adults.
	,,	*F. cherrug*	a. Length 19·5″ to 22″; b. as in *F. jugger;* c. no cheek-stripe, middle tail feathers usually brown, with white spots on both webs.
	,,	*F. milvipes*	a. Length 20″ to 23″; b. as for *F. jugger*, adults banded with rufous on back, wings and tail.
	,,	*F. subbuteo*	a. Smaller, length under 13″; breast white or buff with brown streaks.
	,,	*F. severus*	a. As for *F. subbuteo;* d. breast deep rufous, spotted in adults.
	Æsalon	*A. regulus*	a. Crown grey or brown dark-shafted.
	,,	*A. chiquera*	a. Crown chestnut.
	Tinnunculus	*T. alaudarius*	As for genus.

How to know the Raptores on the Wing.

As I have already stated, most of the Birds of Prey can be as easily recognised on the wing, at a long distance off, as they can from specimens in the hand, but it is not so easy to describe what one can see for one's self, and in many cases, the difference is so very slight that it would be impossible to put it into words. I will not attempt to describe the very subtle distinctions between some species of the same genus, but they are there all the same and to a man who is accustomed to watching birds on the wing, they are plain enough.

I had an old falconer who could differentiate at a glance between the various falcons and between the male of a sparrow-hawk and a female Shikra. I was very sceptical at first as I could not see any difference between the two, until I went out of my way to catch the hawk regarding which I was doubtful, two or three times, and found him right every time. This degree of efficiency can only be acquired by long practice, and most men will be more than satisfied if they can get the length of recognising the majority of birds one comes across during a day's ramble, or see circling round their station.

Though colouration has played a very small part hitherto in this paper, it will be much more prominent now and will considerably aid the beginner in his search, though it is by no means always reliable.

For instance, in describing an adult Imperial Eagle on the wing, the predominating colour to look for is black, whereas the same bird in its first year plumage would be very like a Steppe Eagle and the predominating colour would be brown. If very near, the marking on the breast would serve as a clue, as the young Imperial has a spotted breast, whereas the Steppe would have a plain brown one. The Steppe again can generally be identified by having two buff or whitish lines running parallel to each other, which extend the whole length of his wing, which are lacking in the Imperial. Then again, the Tawny sometimes has one very distinct line and very occasionally a second, similar to the Steppe, which makes it rather confusing, but these are rare exceptions and as a general rule. identification is a fairly simple matter.

I will first take the very large birds according to the predominating colours and endeavour to show the difference between them though the colouring is similar.

Very large birds in which black is the predominating colour.

1. *Otogyps calvus*, Black Vulture.
2. *Aquila chrysaëtus*, Golden Eagle.
3. *Aquila heliaca*, Imperial Eagle.
4. *Aquila maculata*, Large Spotted Eagle.
5. *Ictinaëtus malayensis*, Black Eagle.
6. *Haliaëtus leucoryphus*, Pallas's Fishing Eagle.
7. *Haliaëtus albicilla*, White-tailed Sea Eagle.

The Black Vulture, like all vultures (except *Neophron*) has a very heavy flight, but unlike the others, he will be found to soar with his wings held well back, more like a hunting Eagle than a Vulture. To explain what I mean by wings being " held well back." If a straight pole was placed across the back of a bird in flight, from the tip of one wing to the tip of the other, it would be found that the back of the bird would lie some inches below the centre of the stick, and the bird thus appears to show a great expanse of chest. In most big birds the tips of the primaries have an upward tilt, when soaring, particularly in a strong wind, and light can be seen between the first few quills, *i.e.*, they do not touch each other near the tips. The Hunting Eagles and the Black Vulture, however, do not rest content with tilting up their primaries only, but the entire wing, from the body, curves off at a distinct angle, upwards. The above will explain what I mean when I again refer to the wings being held well back.

In the Black Vulture, the tail projects only a very little beyond the line of the wings, the actual extent depending on whether the bird has got it spread out like a fan, or not.

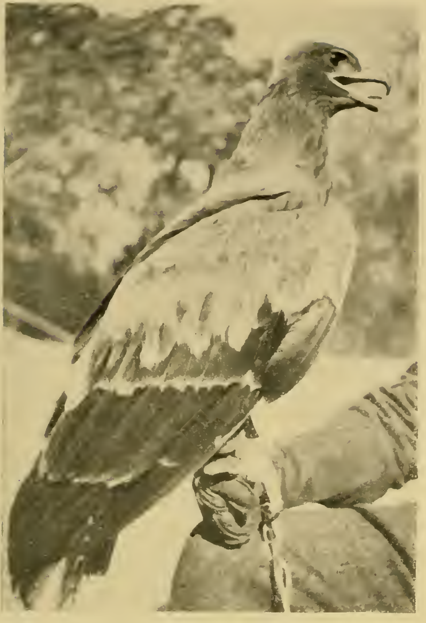
Colouration.—More or less a deep black, with a line of whitish running down the centre of the whole wing. A white spot on the crop and another on each thigh, make this bird unmistakable. If near enough, red skin will be seen near the white patches above mentioned, and possibly the red wattles on his neck.

Aquila chrysaëtus.—Wings curve back very considerably. The tail projects a long way beyond the line of the wings. In an old bird, practically no marking will be seen unless very near, when it will be noticed that the head is a light brown, or at least lighter than the rest of the bird and the middle of the tail may show traces of whitish. In a young bird the head and nape are much lighter than the body and a very conspicuous white patch in the centre of each wing, and a white bar on the tail, can be seen a long way off. This Eagle (the Golden) will not be found on the plains and except in the winter, seldom descends below 7,000 ft. Not at all likely to be found near any station in the hills.

Aquila heliaca.—Flight heavy; wings held in a line with the body. Tail projects beyond the line of the wings only a little more than in the case of a Vulture. Marking very similar to that of a young Golden Eagle except that the head and nape are much more conspicuous, there being much more white about the head than in the young Golden.

The plumage of the young Imperial is entirely different, and will be described later, among birds in which brown predominates.

Aquila maculata.—Smaller than any of the foregoing. Flight very like the preceding species but not so heavy. No distinctive markings of any



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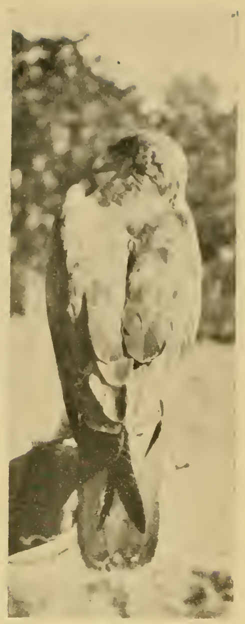

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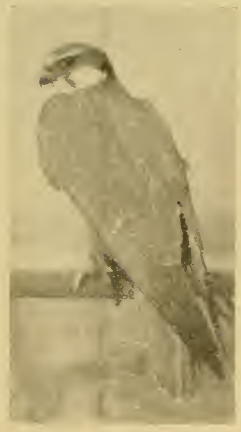

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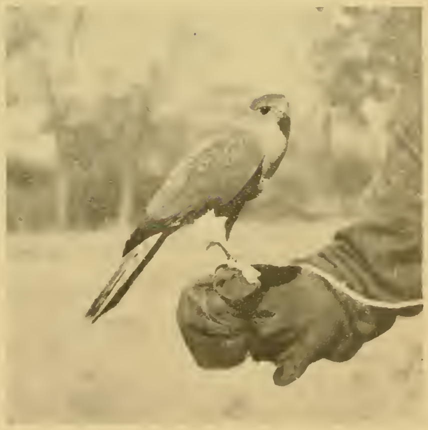

4.

THE RAPTORES OF THE PUNJAB.

1. A Steppe Eagle (*Aquila bifasciata*). Primaries in closed wing reaching tip of tail. 2. A Bonelli's Eagle (*Hieraëtus fasciatus*). The primaries in closed wing do not reach to within 2 or 3 inches of tip of tail. 3. A Laggar Falcon (*Falco jugger*). Long and pointed wings. 4. A Shikra (*Astur badius*). Wings very short.

sort, but sometimes minute patches of white may be seen on the body or wings, being the white basis of feathers showing through.

Ictinaëtus malayensis.—Flight closely resembles that of *A. chrysaëtus* and the wings are held well back. Tail also projects well beyond the line of wings. No markings of any sort and the whole bird appears jet black when flying past. If near, a small patch of brilliant yellow may be seen in the lower portion of the body due to his feet showing.

Haliaëtus leucoryphus.—Very like *A. heliaca* on the wing, but greatly given to flapping. Wings in line with body and as a rule, even the tips of the primaries do not curve upwards. When soaring, shows much more white about the tail than does *A. heliaca.* Extremely noisy. Tail projects a little more than in *A. heliaca,* a broad terminal edge of black on tail.

Haliaëtus albicilla.—Very similar to the preceding species, except that the whole tail appears to be pure white and the broad terminal band of black which is seen in *H. leucoryphus* is wanting. At a very close range a very narrow edging of black on the tip of the tail may be seen.

Dark Brown Birds of Large Size.

Vultur monachus.—Size very large; wings appear to be very broad, held in a line with the body and the tail projects only a little beyond the line of the wings, usually spread out like a fan, when the bird is soaring. Colour a very deep chocolate brown throughout.

Gypaëtus barbatus, immature plumage.—Size very large. Wings long and comparatively narrow, much more pointed than in the Vultures. Tail long and wedge-shaped. Colouring very variable; very dark brown, almost black about the head and neck shading to a somewhat lighter shade on the body and under portion of the wings. Frequently with irregular patches of white, buff or lighter shades of brown, showing on the body and wings. Back and tail usually a dark greyish brown.

Flight easy and graceful, wings held in a line with the body.

The young of—
A. heliaca may all be found in a very deep brown plumage, but
A. bifasciata seldom of a uniform shade throughout. Lighter and
A. vindhiana darker feathers will be found irregularly dotted about
in various portions of the body and wings. *A. heliaca* and *A. bifasciata* are much bigger than *A. vindhiana* and *A. bifasciata*, even in immature plumage, can be identified by two narrow parallel lines of buff or white running along the whole length of the wings.

Archibuteo hemiptilopus
Buteo ferox
Buteo leucophelus
Buteo desertorum

All the Buzzards may appear in a very dark plumage, but will almost always display a lighter patch in the centre of each wing, and regular markings of a lighter brown on the wings and tail. Not much given to soaring, but when they do soar, the flight is easy, bold and graceful. The wings are held slightly back but do not curve upwards nearly so much as in *A. chrysaëtus.*

Milvus govinda
,, *melanotis*
,, *migrans*

All dark brown throughout, with sometimes irregular markings of whitish buff or light brown. In *M. melanotis* there is a big buff wing patch, which is also visible to a lesser degree in *M. govinda.* All the kites can be identfied by their forked tails. Flight is easy and light but irregular and frequently changing direction as though the bird is uncertain as to which line it should take. The wings are held in the same plane as the body and are frequently slightly bent as though the bird was meditating a stoop.

Spilornis cheela.—The Crested Serpent Eagle is a very deep chocolate brown with numerous whitish bars on the wings and tail. If at close quarters it will be seen that the whole body and the lining of the wing is covered with small white " occelli. When scaring the wings are held well back, but are broad in proportion to his size, hence the tail does not project very far beyond the tertiaries. This is a noisy bird and gives vent to a shrill succession of whistles when on the wing. Found in the lower hills among Chir pine (*P. longifolia*) and oak (*Q. dilitata*) up to about 6,000 feet and is often found in the vicinity of paddy fields and streams. Little bigger than a kite.

Circus æruginosus (female).—Not unlike a kite except that the tail is rounded and not forked. Usually a darker and more uniform brown, with a buff head and nape. Wings usually held in a line with the body but sometimes they curve up a little. Seldom bent, as in kites, and much given to flapping. Usually found over water. A little smaller than a kite.

Light Brown Birds with Markings.

The true Eagles of the genus *Aquilia, i.e.,* the Imperial, the Steppe and the Tawny Eagles as I have already shown may be either dark brown or come under the present category of light brown birds, and the Steppe may even be so dark as to look black, but in his case the ubiquitous white stripes are always present in a greater or lesser degree.

There is no necessity to describe the flight of each species over again and suffice it to say that the true Eagles can always be separated from the Vultures in having somewhat narrower wings in proportion to their size, and the tail projecting, even when spread out, a little more than in the case of the Vultures. The flight is lighter, *i.e.,* the bird appears to be carrying less weight. If you watch a Vulture carefully, it will be seen that once he has got into his stride, as it were, there is no wavering about the flight and he circles in perfect curves, the wings being stretched to their full and perfectly still.

With the Eagles, on the other hand, there is more wing motion and the circle is not so true as in a Vulture.

The wings, too, are frequently seen to be slightly moving near the tips. One minute the primaries curl upwards and the next are slightly depressed, as though the air currents played tricks with their lesser weight and they had to meet each change with a slight movement of the wing.

Among the birds of the size of a Kite or larger, in which light brown predominates are the *Hieraëti* and the *Spizaëti*, both genera of hunting Eagles, which, with one exception, hold their wings very far back. The exception is *H. pennatus* which is particularly Kite-like in its flight.

The other species of the same genus, *Hieraëtus fasciatus*, the Bonelli's Eagle, is a grand bird on the wing and looks like a miniature of the Golden Eagle, except for the colouring.

Hieraëtus fasciatus.—A young bird is rufous underneath with grey brown wings and tail, whereas in his adult plumage the rufous on the body gives place to white, finely mottled with brown. The older the bird the more white is his body, the wings varying from light grey-brown to dark grey brown and to black on the tips of the primaries. Nearly always seen in pairs, either beating over grassy hillsides or soaring over a station in quest of pigeons.

Hieraëtus pennatus.—As unlike the preceding species, in flight, as it is possible to have them. Very much smaller in size (being the smallest of all Eagles with feathered tarsi). One phase of plumage of this species is a light to dark brown generally, with irregular lighter and darker patches and mottling on wings and body. Flight light and easy but not exactly bold or graceful. Wings held level with the body and often, like a Kite's, the tips of the primaries appear to be on a lower level than the body, and bent from the wrist, backwards and downwards. The usual plumage is not unlike "*Neophron*", *i.e.*, a dirty white throughout the underparts, with a black marginal band running along the tips of the wings, about 4″ or so wide. The back is a mixture of dark brown and black as also the upper portions of the wings. Tail projects well beyond the tertiary quills.

Spizaëtus limnaëtus
Spizaëtus nepalensis

Unmistakable in flight. Wings very short and round, held very far back and the tail projecting far beyond the line of wings. The underparts may be a uniform light brown or, in old birds, the breast may be almost as white as in *H. fasciatus,* but more mottled with dark brown spots. Soars well and is often seen to give several short sharp flaps after a bout of circling on steady pinions. Size about that of a Kite. Usually found over heavy pine or oak forests.

Circaëtus gallicus.—A very light silvery brown throughout, almost a greyish white sometimes. Soars well. Wings held slightly back, the tips curled well up. If seen near, a dark streak will be noticed near the chin and another black line near the extreme end of the wing. Generally found over grassy plains and is one of the five Birds of Prey which hover. At close quarters his breast will be seen to be pure white, closely barred and mottled with brown. Upper parts dark grey.

VULTURES.

Gyps fulvus
Gyps himalayensis

Large birds, black and white or dark-grey and white. Very large birds with a true Vulturine flight. Colouring, chiefly a dirty creamy white throughout with a deep band of black along the edge of the wings. Young birds vary.

Gyps indicus
Gyps tenuirostris
Pseudogyps bengalensis

Smaller than the above with a similar flight. Predominating colour black or a very dark grey with a line of white on the wings. In many cases the wings appear to be half black and the other half white, mixed with grey.

The last species displays a great deal of white on the back, as he turns.

Polioaëtus ichthyaëtus
Polioaëtus humilis

These Fishing Eagles are not given to soaring and are usually to be found sitting on trees overlooking some mountain, river or stream, or flying up and down it. The flight is rapid and the beats of the wing sharp and full. Colouring a deep grey on the back. Light grey on the head and neck and upper breast, fading to white on the abdomen.

Pandion haliaëtus.—The Osprey is not often found soaring high in the heavens, though he might easily be seen circling over a tank or jheel. Underparts white with brown streaks and mottlings. Wings and back dark grey or brown, quills blackish. Wings held in a line with the body, often slightly bent from the wrist backwards and downwards. Much given to hovering and dropping head first, like a Kingfisher, right under water, whence he will emerge and almost invariably shake himself as he rises out of the water.

This disposes of most of the bigger birds and leaves the Falcons, Hawks and Harriers and the little Black Winged Kite.

Elanus cæruleus.—About the size of a pigeon, but with longer wings. Colour black and white. Underparts of the body and half the wings white. The quills black and the upperparts a very dark-grey to black. Flight jerky, with long full beats of the wings. Not given to soaring but a past master in the art of hovering. Found over scrub jungle as a rule.

THE TRUE HAWKS.

Astur palumbarius
Astur badius
Accipiter nisus
Accipiter virgatus

The first named is easily identified by his greater size, so far as the female is concerned.

All the Hawks have very short rounded wings and long tails in comparison to their size. All soar well but do not keep up circling like the Eagles. After attaining a good height they will be seen to go off in some particular direction and then suddenly close their wings and drop straight down, either after birds or merely into a tree.

In the course of circling they will be often seen to give a few short rapid beats of their wings and then continue circling.

Falcons.—Are the antithesis of Hawks. They have long pointed, swallow like wings and shorter tails and may be identified as such at any height. They all soar well. When soaring the wings are held straight and on the same plane as the body, but when flapping, the wings are usually bent as though preparing for a stoop.

Of the falcons, the Laggar is perhaps the commonest and the most easily identified, in the case of an old bird, on account of the white breast and the white marking on the wing lining. They usually hunt in pairs. While the identification of the Falcons is by no means difficult in most cases, to describe the subtle differences between each is, I am afraid, beyond my power.

Merlins.—These little birds seldom or never soar. The "Turumti" nearly always hunt in pairs and may be seen flying very low along the ground at an incredible speed, when their keen eyes have detected small birds feeding on some open "maidan," or over the tops of the trees, never very high up. Their little grey wings work at a tremendous pace and the white body is a certain guide.

The Merlin (*A. regulus*) does not hunt in pairs and is much darker in colour. It generally flies very fast with sharp short beats, with half closed wings.

Butastur teesa.—The flight of this bird is not unlike that of a true Hawk. except that his wings are longer and more pointed, though not nearly as long or pointed as that of a Falcon's. Given to soaring a great deal in the spring. From below has the appearance of being silvery white. The flap is slower and more deliberate than that of a Hawk. Talks a lot when he is soaring. A not unmusical 3 note call which sounds something like "whityu-whyu." Usually displays a very light buff patch on the nape. Dark grey above and light grey beneath. Breast much mottled. The Honey-Buzzard (*Pernis cristatus*) very much resembles the Goshawk in flight, except that it is a good deal bigger. Generally found in gardens and groves or along Canal banks. Flies rapidly and hurriedly from one tree to another and usually pursued by crows, mynahs, king crows, &c. Does not often soar but is occasionally found high up during the spring.

Birds in which White or Light Colours predominate.

Gypaëtus barbatus.—The Lammergeyer in adult plumage is unmistakable. I have already said with reference to the young bird that his long narrow wings and the wedge-shaped long tail are sufficient to proclaim him at almost any height, and when, added to that you have a bright golden, head, neck and body with grey wings and back, he is hard to mistake for anything else. This bird is often seen flying low along a hill side with very bent wings, and in that condition they appear exceedingly pointed.

The Harriers.—I have already described the female of the Marsh Harrier. The males of the Hen Harrier and the Pale Harrier, in adult plumage, look pure white below, with a line of black running along the edge of the wings. The upper parts, when seen vary from light grey to almost black. The male of the Marsh Harrier in adult plumage is rufous about the breast and body generally and there is a lot of light blue-grey about the wings, the tips being black. The hens of the two first mentioned are a light brown throughout, profusely speckled and spotted along the underparts, the brown being darker and more uniform above. A light buff collar is frequently visible as the bird flies past. A patch of white is visible on the lower portion of the back, near the root of the tail, which is much more pronounced in the Hen Harrier than it is in the other species. These birds do not often soar, except in the Himalayas, on their way to and from the plains, and are usually found beating over low scrub or grassy plains, with strong steady beat of the wings and checking every now and again to drop silently into a bush after some small bird.

The Buzzards.—I have already described the Buzzards in their melanistic phase of dress but they as frequently appear in a plumage which varies from light rufous brown to pure white on the head, neck and breast. It is impossible to describe the plumage of this genus here, as it varies from the one in which dark brown predominates to the very light rufous in which white plays an important part, even if it does not predominate and various phases between these two extremes are by no means uncommon.

Neophron.—The Scavenger Vultures vary, if anything, even more than the Buzzards. From the dark brown of the immature plumage to the pure white (usually a dirty white), with black margins to the wings, of the adult plumage. The flight of the Scavenger Vultures is not unlike that of *Gypaëtus barbatus*, both having long narrow wings and a wedge-shaped tail, but the latter is, of course, more than twice the size. Wings are held in a level with the body, and the flight is light, easy and graceful and the bird, in the air, cuts a very different figure to the ungainly, untidy bird one is accustomed to see on the ground.

When once the flight has been mastered it is extraordinary how very simple identification becomes, even in abnormal specimens. Take for instance a Kite without a tail, a common enough sight, yet there is no mistaking it for what it is, in spite of the fact that a forked tail is its chief characteristic.

I have been told on more than one occasion, that to know a Kite is simple enough, but a Kite will not go far to help one to recognise other species. The Kite will not help you but familiarity will. Everybody is familiar with the deportment of a Kite and can recognise it under any circumstances, simply because it is almost impossible to go out of a house without seeing one and the average person, unwittingly, takes in the various tricks of its flight and becomes gradually familiar with them. The same is possible with all other species, once a beginning is made and one has got into the way of watching for the characteristics.

From the above it must not be presumed that a mistake is impossible, but given normal specimens, I do maintain that in 80 per cent. of cases it is fairly easy to arrive at the correct conclusion with a little practice.

N. B.—Mr. Hume in "Rough Notes" gives some very interesting measurements of the wings of Eagles from which it will be seen that in some specimens the tip of the primaries in the closed wing fall short of the tip of the tail by as much as $2\frac{3}{4}$ inches. This might possibly be the case in certain individuals but these must be treated as rare exceptions. In a specimen in which the tail has moulted and attained its full length before the primaries for instance, but as a general rule the wings of the true Eagles will not fall short of the tip of the tail by more than an inch or so, whereas in the case of the Hawk-Eagles $2\frac{1}{2}''$ will be the minimum and as a rule a good deal more. The genus *Hieraëtus* though more of a Hawk-Eagle than a true Eagle, has longer wings than the *Spizaëti* and his method of hunting is essentially that of a long-winged Eagle or Falcon, *i.e.*, in the open and not among trees.

2. The measurements of the tarsi of the Imperial Eagle (Hume's "imperialis") is given by Mr. Hume in his above work as varying from 3·75″ to 4·06″ but it must be remembered that Mr. Hume has ignored the Steppe Eagle as a species and has treated it (*A. bifasciata*), as merely a phase of the Imperial in its transition stage of plumage, and hence his measurements of the tarsi of the Imperial, include those of the Steppe, as well. In its lineated or immature plumage the Imperial bears a close resemblance to the Steppe but whereas the Steppe is never mottled on the breast and is always a more or less uniform shade of brown, the young Imperial has the feathers of the breast brown with whitish shaft stripes.

That is, the centre of each feather is lighter than the rest of it, giving it a distinctly mottled appearance. Whereas the tarsus of the Imperial is shorter than that of the Steppe, the foot and claws are bigger.

3. Occasionally a specimen may be met with which will be difficult to identify as either a Steppe or a Tawny, and bearing a very close resemblance to both. That the species occasionally interbreed is, I think, possible and I can give two instances which make me think they do, but as neither case proves anything definitely we must wait for further instances and more conclusive proof before accepting the theory.

On one occasion I saw an undoubted female Steppe Eagle carrying sticks to a nest off which I had caught a male Tawny only an hour or two previously. On yet another I shot what I took for a Tawny, very high up in the Himalayas, just about the time when the Steppe Eagles would be finding their way down to Northern India (in the autumn). This specimen had undergone a complete moult, with the exception of a few back and head feathers, and yet did not show a single trace of the white wing stripes. The tips of the secondaries and the feathers of the wing underlining were a rich brown like the rest of the wing. The size too was that of a Tawny and yet the tarsus measured just over 4″ and the fact of the bird being found so far up in the hills pointed to it being a Steppe. The tarsus is, however, a sure indication between these two species so long as the type is true to the species and abnormal specimens or possible hybrids need not be taken into count.

ON THE DETERMINATION OF AGE IN BATS.

BY

KNUD ANDERSEN, F.Z.S.

(*With a plate.*)

The question was once put to me by a fellow zoologist: "What is the possible age of one of our small insectivorous bats, supposing it is allowed to live its normal span of years without accidents of any kind?" I had to confess that we knew practically nothing about it. Insectivorous bats, any species, are extremely difficult to keep alive in captivity, and Horseshoe-Bats are among the most intractable of all; I am not aware that any species of these latter has been kept in confinement for more than a few weeks. But even if this were otherwise, the length of its life in captivity would of course, give us no reliable information of the age the individual might reach under the totally different conditions of Nature, though it might in the most favourable cases give us an idea of the lowest possible age of the individual under natural conditions. There is another way to approach the problem, so long as we have no better facts to judge from. The length of the period of immaturity will, as a general rule, in some vague sort of way enable us to form an opinion of the normal age the individual is destined to obtain; a mammal which quickly becomes full grown will probably have a rather short series of years to live as adult, and *vice versa*. There may be hundreds of exceptions from this rule among lower vertebrates, but I doubt that there are many among mammals. Insectivorous bats have only a short period of immaturity, species of the size of the Rufous Horseshoe-Bat of India (*Rhinolophus rouxi*) hardly more than about six months (I am speaking of the period of growth, not of the time required for sexual maturity, of which we know but little in the case of most bats), and their life-time may therefore be supposed not to be very long. A more definite answer it has, to my knowledge, till now not been possible to give.

Although I do not deny that it might be interesting to be able to answer the question just referred to, there is another problem, closely connected with this, and which in my opinion is of more practical importance. It is this. If an insectivorous bat is placed in our hands, have we then any means by which to determine its age? The question may be answered both ways. It is easy enough to decide whether it is immature or adult (by examining the epiphyses at the distal ends of the metacarpals, which can be done by simple exterior inspection, without injuring the individual). Supposing it to be adult, it is again easy enough to tell, by the degree of wear of its teeth, whether it is a youngish adult, a middle aged, or an aged individual. But when it comes to the question of months or years, we must give it up.

I consider this question, as to the actual age of a given individual, for practical purposes more important than the question of its possible extreme span of life (but the solution of the former will, of course, ultimately lead to the solution of the latter, as we shall see later on). To give one instance among many. Certain Horseshoe-bats show a truly bewildering "variability" in the colour of their fur, and the Indian *Rhinolophus rouxi* is in this respect one of the most perplexing of all. Have these colour "variations" anything to do with the sex or season (these questions it ought to be possible to settle at once by reference to the labels of the specimens) or with the age of the individuals? I have had to attack this problem lately, when working out for the British Museum "Catalogue of Chiroptera" the unusually fine series of *Rh. rouxi* collected by Mr. Guy C. Shortridge for the Bombay Natural History Society's Mammal Survey of India,* and it has naturally induced me to study more closely the different stages of wear of the teeth, with the object of finding in them a possible means to determine the age of each individual. This paper gives my conclusions.

A few words to explain my method. To eliminate, as far as possible, all sources of error, should be our first consideration. An ideal material would therefore be this :—We require, as a basis, to begin with, a series of specimens all collected approximately on one day or at least within the space of about a month, and showing all stages of wear of the teeth; provided they really show all degrees of wear found on that date or in that month, we shall be able to sort them out in so and so many stages, separated by one year. In many cases we should require an enormous series of individuals in order to have all stages represented, in others, with more good luck, a much smaller series will contain all the stages. Further, this series ought to be collected, if not exactly on the same spot, at least within the same faunistic area, to make reasonably sure that differences in food have not influenced the degree of wear of the teeth. If we have succeeded so far, we still require any amount of material of the same species from every other month of the year (but preferably from the same area), in order to check the results we obtained by our first series.

It would be too much to say that the Shortridge material fulfils, absolutely, these ideal conditions, but it comes sufficiently close to them to be workable. It contains forty individuals, not from one month, but from two consecutive months, *viz.*, October and November, all from the same district, and I have reason to believe that they show all stages of wear, possibly (not certainly) with exception of an extreme senile stage. It has further the advantage of being from October and November, thus containing a good number of individuals just adult (supposing the young of this species, in that particular region of India, to be born in April or May, which, judging from the fœtuses I have seen, they probably are, as a rule), showing the first stage of wear, that of adult specimens about six months old. It further contains sixty-four adult specimens from the same zoogeographical area, not from the ten other months of the year, but from four (January, February, April and May), sufficiently distant to check the results derived from the October-November series.

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* See my paper "On the so-called colour phases of the Rufous Horseshoe-batof India" (*Rhinolophus rouxi*, Temm.), this Journal, *infra*.

Those not familiar with the molar structure of a *Rhinolophus* should examine fig. B, on the plate accompanying this paper, and the explanation of that figure on p. 258, before proceeding to read the next paragraph.

The different stages of wear of the anterior upper molar in October-November individuals.

First stage (fig. I).—The molars in this stage are so little worn that it requires some care, and often the use of a good pocket lens (or better still, a dermatoscope), to discover the traces of wear. The commissures (1-4, 2-4, 2-5, and 3-5; see fig. B) are no longer absolutely sharp-edged, as in the perfectly unworn tooth; that is, they show, not one single line (like a razor edge), but distinctly two sub-parallel lines very close together, and between these lines an exceedingly narrow sublinear flattened edge. Similarly, the ridge of cusp 6 is not single-edged, but shows two more or less parallel lines; its central portion is always a little more worn than the ridge in front of and behind it, because it, being the highest point of the ridge, is more energetically acted upon by the corresponding tooth of the lower jaw (cusp 5 of m^1). Viewed in profile from the inner side (a′ and b′) cusps 4 and 5 will be seen to be not absolutely sharp-pointed, but already with the points slightly blunt.

The individual variation in the degree of wear at this stage is small. Figs. Ia and a′ show the minimum, figs. I b and b′ the maximum among eleven individuals from the months of October and November.

Second stage (fig. II).—The worn edges of the commissures are in this stage twice to three times as broad as in stage I; the breadth (side to side) of the worn edge of cusp 5 is almost 1/2, or in any case nearer 1/2 than 1/3 (in stage I roughly 1/4) of the total length of commissure 2-5. The worn edge of cusp 6 begins now to assume in its central portion a pronounced subtriangular (irregularly triangular) shape, but is still sublinear in front of and behind this central portion. Viewed in profile from the inner side (a′ and b′) cusps 4 and 5 are seen to be distinctly lower than in the first stage; the height of cusp 4 is now hardly equal to (in stage I rather more than) the distance between the tips of cusps 4 and 5; the height of cusp 5 is still equal to or a little more than (in stage I conspicuously more than) the same distance.

Twelve individuals in this stage have been examined. Figs. IIa, a′ and IIb, b′ represent the minimum and maximum of wear.

Third stage (fig. III).—The worn surfaces of the commissures are considerably increased in area; the breadth of cusp 5 is now between 1/2 and 2/3 of the total length of commissure 2-5. Equally, if not more, characteristic is the shape and enlargement of the worn surface of cusp 6; the "triangle" occupies now not merely the central portion of the ridge, but extends forward to the very base of cusp 4. Cusps 4 and 5 are worn considerably lower (IIIa′ and IIIb′); the height of cusp 4 is much less than (about 1/2-2/3) the distance between the tips of cusp 4 and 5, the height of cusp 5 is somewhat less than the same distance.

There are seven individuals in this stage in the material from October and November. The minimum and maximum of wear are shown in fig. III a, a′ and b, b′.

Fourth stage (fig. IV).— Easily distinguished from the third stage by the increased breadth of the worn surfaces of the commissures, the much enlarged triangular surface of cusp 6, and the considerably lower cusps 4 and 5. The breadth of the worn surface of the commissures at cusp 5 is now 3/4, or more than 3/4, of the total length of commissure 2-5. The triangular surface of cusp 6 tapered in stage III to a point at the foot of cusp 4, now it is quite broad in front, and the tooth worn quite thin at its antero-interior corner. Cusp 4 is now so low that it only rises a little above the worn surface of cusp 6, its height being about 1/3-1/4 the distance between the tips of cusps 4 and 5; cusp 5 is correspondingly lower its height about 1/2, or less than 1/2, of the same distance.

Six individuals show this stage. Fig. IV represents as usual the maximum and minimum of wear.

Fifth stage (fig. V).—The final stage, at least so far as my material goes; the molars are now worn down to the level of the gums. The characteristic features of this stage are these:—Cusp 4 has disappeared, having been worn completely down to the surface level; the worn surfaces of commissures 1-4 and 2-4 are therefore now perfectly confluent with the "triangle" representing the worn surface of cusp 6. Cusp 5, which from the very beginning is higher than cusp 4, has either nearly or quite disappeared. Although these differences in the degree of wear of cusp 5 are only individual (not indicative of different "stages", as the word is here understood) it is important to note them, as they happen to give a different aspect to the surface of the tooth. If cusp 5 has very nearly, but not quite, disappeared, the inner (median) margin of the confluent worn surfaces of commissures 2-5 and 3-5 closely approaches, but is not in contact with, the opposite margin of the worn surface of cusp 6 (fig. V a). Fig. V b represents an individual in which the two margins actually touch each other. Finally, Fig. V c, an individual in which these margins have disappeared, so that the worn surface of cusp 6 is confluent not only in front with commissures 1-4 and 2-4, but also posteriorly with commissures 2-5 and 3-5, and the deep pit, which in the less worn tooth separates cusp 4 from cusp 5, has been transformed into an island pit in the centre of the tooth. I have already alluded to the fact that these degrees of wear of cusp 5 are undoubtedly purely individual; the five October skulls representing this fifth stage of wear show perfect intergradations in this respect.

These are the stages of wear represented in a series of forty skulls of *Rhinolophus r. rouxi* from October and November (South Mysore and South Mahratha Country). Various reasons have led me to the conclusion that they are five *consecutive* stages, with one year between:—

First, the amount of wear leading from stage I. to II. is similar to that leading from II. to III, or from III. to IV, or from IV. to V, if we bear in mind the fact that the ratio of wear is gradually accelerated in proportion as the enamel coat is more and more completely worn away from the surface of the tooth. With this necessary qualification the stages are evidently equidistant so far as the amount of wear is concerned, and it appears reasonable to deduce that they are equidistant in point of time as well.

Second, I have submitted this conclusion to the test of all other available skulls of *Rh. r. rouxi* in so far as these are exactly dated. Apart from the forty October-November skulls, I have examined sixty-four from the months of January, February, April, and May, all from the same geographical district (N. Kanara, Savantwady, Konkan). Every one of these sixty-four skulls is easily referable to one or other of the five stages described above, allowing of course for the slight additional wear due to the more advanced season; the main point is, that there is no trace of the existence of any other "stage." Our series really seems to be complete, so far as it goes. It may be necessary to add these words, "so far as it goes," for it is just possible that a sixth stage occurs, one year beyond the fifth. I should hesitate to consider it probable, seeing that in the fifth stage the molars are practically reduced to the very level of the gums, but on the other hand it is not absolutely inconceivable that a sixth stage exists, though it would no doubt be rare.

Presuming, therefore, that our series is complete, we have of course only to determine the age of the individuals of the first stage, which will give us at once the age of each of the subsequent stages. As to that question there is no uncertainty at all. The actual degree of wear in this first stage would be sufficient to tell us that the individuals can be only just adult, that is (supposing they were born in April or May) about six months old. This conclusion is further supported by the fact that in the case of five individuals in this stage I am able to say, on the strength of certain external characters, that they are " bats of the years."*

We are thus enabled to fix the ages of our October and November individuals as follows :—First stage, about 6 months; second, about 18 months; third, about 2½ years; fourth, about 3½ years; fifth, about 4½ years. If to this we add a minimum of half a year and (supposing that a sixth stage does occur occasionally) a maximum of a year and a half, we arrive at five or six years as the extreme possible age of this bat. If one should have hazarded a simple guess at the probable age limit of a bat of this size, it would have been very much the same.

Strictly speaking, both the facts and the conclusions recorded above are, of course, only valid for *Rh. rouxi*, or more narrowly still for individuals of this species from South and Central India. I should think, however, that other bats of about the same size, with the same molar structure, and dependent on a similar diet, would not differ very much in this respect.

My object has been to determine the probable age of each individual in the series under consideration, and I have therefore confined myself to what was necessary for this purpose. To grasp the alterations taking place, from year to year, in a single tooth is really all that is needed, and by focussing the attention on one tooth, rather than describing in detail the alterations by wear in the whole tooth row, I hope I have made my paper not only much shorter, but clearer as well, and the facts more easy to remember. Still I ought perhaps in conclusion to add a few words about the other teeth.

The first upper molar is one of the teeth best suited for our present purpose; it is one of the most complicated in structure, and therefore shows most readily the effects of wear. The second molar differs in no very important point from the first, and might almost as well have been selected for description here; the surface wear affects it very nearly in the same way, and it reveals the age of the individual almost as clearly as m^1. The third (last) molar is somewhat degenerated, and both for this reason and owing to its position farthest back in the row the five stages of wear described above are not nearly so sharply separated from each other as in the case of m^1 and m^2. The posterior premolar behaves somewhat differently from the molars; its sharply pointed cusp is the highest in the postcanine row, and its function is no doubt (so long as it retains this shape) chiefly to keep the food in position while it is acted upon by the molars; being not a "crusher" like the molar, but rather (together with the canine) a "fork," it is differently affected by the wear; in the earlier years of the individual it is more slowly worn than the molars, but a time comes (usually somewhere about the fourth stage) when the originally high cusp is worn low and at the same time all molars much flattened down, and it would seem that now the animal finds it advantageous to use it more as an additional crusher; from this period onwards it wears down much more quickly; as an indicator of age it is on the whole too capricious, too irregular in wear. The anterior premolar is a small rudiment; and the only remark it calls for in this connection is that, in spite of its minute size, it cannot be functionless; it is easy to see that it is acted upon by the high cusp of the posterior lower premolar, and it shows progressive stages of wear like all other teeth (with one exception pointed out below); even in extreme old age it is never absent. The upper canines are so simple, hook-like in shape, as to be of little value for our present investigation; the sharply pointed tip is, of course, worn blunt and the tooth gradually shortened, but it follows rather the rule of the posterior upper premolar, *i.e.*, the effect of the wear is slower in the earlier than in the later years, and the progress of the wear is somewhat irregular; in the majority of skulls in the second stage the tip of the canine is clearly slightly blunt, but there are other skulls in the same stage in which the canines would be hard to distinguish from those in the first stage. The minute upper incisors show very distinct signs of wear; they bite, not against the lower incisors (which close in far in front of the upper ones), but against the inner cingulum of the lower canines. The lower molars have a simple W-shape, *i.e.*, three cusps (1, 2, and 3) on the inner, two (4 and 5) on the outer side, cusp 6 and the heel (7) are absent; but in spite of the fact that they are considerably less complicated than the upper molars, I find that any of them might be used to measure the wear and age of the individual, though they are much more difficult guides than the first and second upper molars. The rudimentary middle lower premolar is usually squeezed out to the external side of the tooth row, though occasionally (in about 15 per cent. of the individuals) it is halfway or completely in row; it is sometimes external on one side of the jaw, more or less in row on the other; though even smaller than the first upper premolar it is very rarely absent (in one skull only, among 134; this individual is not very old, little more than 2½ years); it shows stages of wear, being acted upon, in certain positions of the jaw, probably by the tip of the upper canine. Of all teeth the lower incisors are the least affected by wear; I fail to see that they can possibly come into contact with any other teeth; even in the oldest individuals their edge very often, perhaps as a rule, remains trilobed.

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* They are individuals who had just completed their first (autumn) moult, and the new coat of which was changing from the dark to the first (auburn) "phase". Their numbers are 1943 and 1947-1950, all from Seringapatam, South Mysore, 18th October 1911. (See the paper already referred to, on the colour phases of *Rh. rouxi*.)

In the unworn and little worn stages, the highest cusps in the upper molars are those in the middle row (4 and, even more, 5), in the lower molars the anterior outer cusp (4). The upper molars, therefore, slope from the middle outward, while the lower molars are highest at their outer side anteriorly. This is completely altered by the wear of the teeth. Owing to the fact that the lower tooth rows are much closer together than the upper, the lower molars act most vigorously on the middle and inner portions of the upper teeth, and the upper molars most strongly on the outer side of the lower teeth, with the result that in the final (fifth) stage of wear, when the molar surfaces are nearly or quite flat, the upper molar surfaces slope strongly and evenly from the outside inward, the lower molars from the inside outward.

Ages of 104 *individuals of Rhinolophus rouxi.*

Subjoined are the details of all the dated specimens examined. All except seven were collected by Mr. Shortridge for the Mammal Survey of India.

1. *October and November individuals.*

28 specimens (all adult females), Seringapatam. S. Mysore, 18th and 19th October, 1912. 12 specimens (4 ♂ ad., 8 ♀ ad.), Devikop, 26 miles south of Dharwar, S. Mahratha Country, 21st and 25th November, 1911. The November specimens are marked with an asterisk. Total number, 40.

Stage I (about 6 months old).—10 individuals. G.C.S. 1943, 1947, 1948, 1949, 1950, *137, *139, *141, *174, *177.

Stage II (about 18 months old).—12 individuals. G.C.S. 1936, 1939, 1954, 1955, 1957, 1958, 1959, 1960, 1962, *134, *138, *178.

Stage III (about 2½ years old).—7 individuals. G.C.S. 1934, 1937, 1946, 1956, 1963, *179, *181.

Stage IV (about 3½ years old).—7 individuals. G.C.S. 1935, 1938, 1944, 1961, *140, *180.

Stage V (about 4½ years old).—5 individuals. G.C.S. 1940, 1941, 1945, 1951, 1964.

2. *January and February individuals.*

2 specimens (♂ ad.), Sirsi, N. Kanara, 11th January, 1900. 19 specimens (4 ♂ ad., 15 ♀ ad.), Potoli, south-east of Supa, N. Kanara, 18th and 19th January, 1912. 3 specimens (1 ♂ ad., 2 ♀ ad.), Dandeli, 15 miles east of Supa, N. Kanara, 21st January, 1912. 2 specimens (♂ ad.), Barchi, 10 miles east of Supa, N. Kanara, 28th January, 1912. 1 specimen (♂ ad.), Yellapur, N. Kanara, 20th February, 1900. The single February specimen is marked with an asterisk. Total number, 27.

Stage I + (about 9 months old).—11 individuals. B.M. 0·4·1·6 G.C.S. 519, 520, 522, 529, 541, 546, 547, 556, 557, 564.

Stage II + (about $1\frac{3}{4}$ years old).—12 individuals. B.M. 0·4·1·7 and *0·4·1·8. G.C.S. 523, 524, 525, 526, 528, 540, 542, 544, 548, 563.

Stage III + (about $2\frac{3}{4}$ years old).—3 individuals. G.C.S. 527, 543, 545.

Stage IV + (about $3\frac{3}{4}$ years old).—1 individual. G.C.S. 558.

Stage V + (about $4\frac{3}{4}$ years old).—None.

April and May individuals.

10 specimens (all adult males), Sirsi, N. Kanara, 8th to 12th April, 1912. 3 specimens (1 ♂ ad., 2 ♀ ad.), Nerur, Savantvadi, 17th April, 1911. 21 specimens (15 ♂ ad., 6 ♀ ad.). Hulekal, near Sirsi, N. Kanara, 18th to 26th April, 1912. 1 specimen (sex uncertain), Asgani, Konkan, 3rd May, 1911. 2 specimens (♂ ad.), Gersappa, N. Kanara, 19th and 23rd May. 1912. The May specimens are marked with an asterisk. Total number 37.

Stage 1 + (about 1 year old).—21 individuals. B.M. 11·7·18·3 and 4. G.C.S. 853, 898, 956, 957, 958, 959, 960, 962, 964, 965, 966, 967, 987, 988, 989, 1009, 1012, *1158. B.M. *11·7·18·1.

Stage II + (about 2 years old).—12 individuals. G.C.S. 847, 895, 896, 897, 899, 900, 910, 990, 994, 996, 1011,*1120.

Stage III + (about 3 years old).—4 individuals, B.M. 11·7·18·2. G.C.S. 889, 961, 1010.

Stage IV + and V + (4 and 5 years old). None.

The total number of individuals in stage I or between I and II is, therefore, 42 (40·4 per cent.); in stage II or between II and III, 36 (34·6 per cent.); in stage III or between III and IV, 14 (13·5 per cent.); in stage IV, or between IV and V, 7 (6·7 per cent.); in stage V, 5 (4·8 per cent.). If this series taken as a whole, gives anything like the normal proportion of individuals found in nature at the different stages of age, it will be seen that individuals up to two years old ($\frac{1}{3}$ of the extreme possible age) form 75 per cent. of the total "population"; individuals up to the three years limit (half the extreme span of life) no less than 88·5 per cent. But 104 is, of course, far too perilously small a number to serve as a basis for an age census, and I do not attach too much importance to the percentages here arrived at, though it is a fact that they agree very well indeed with my experience as to the great abundance of individuals with little or moderately worn teeth and the relative scarcity of aged and senile individuals in any series of bats, of any species. Twelve different localities are represented in this series of 104 specimens, but only in one single place was the oldest stage (V) secured.

Explanation of plate.

All figures are of the subspecies *Rhinolophus rouxi rouxi*, and all individuals are from October or November. Figures I—V represent the anterior upper molar (m′) of the left side, viewed from the surface and from the inner side, and in about 10 times natural size. Those marked I are in the "first" stage of wear as defined in this paper, those marked II in the second, and so on. In all figures, *a* and *b* (and *c*, if present) are surface views, *a′* and *b′* (and *c′*) inner and somewhat oblique side views. Figures A and B (top of plate) are given for the information of those who are not familiar with the dentition and molar structure of this bat.

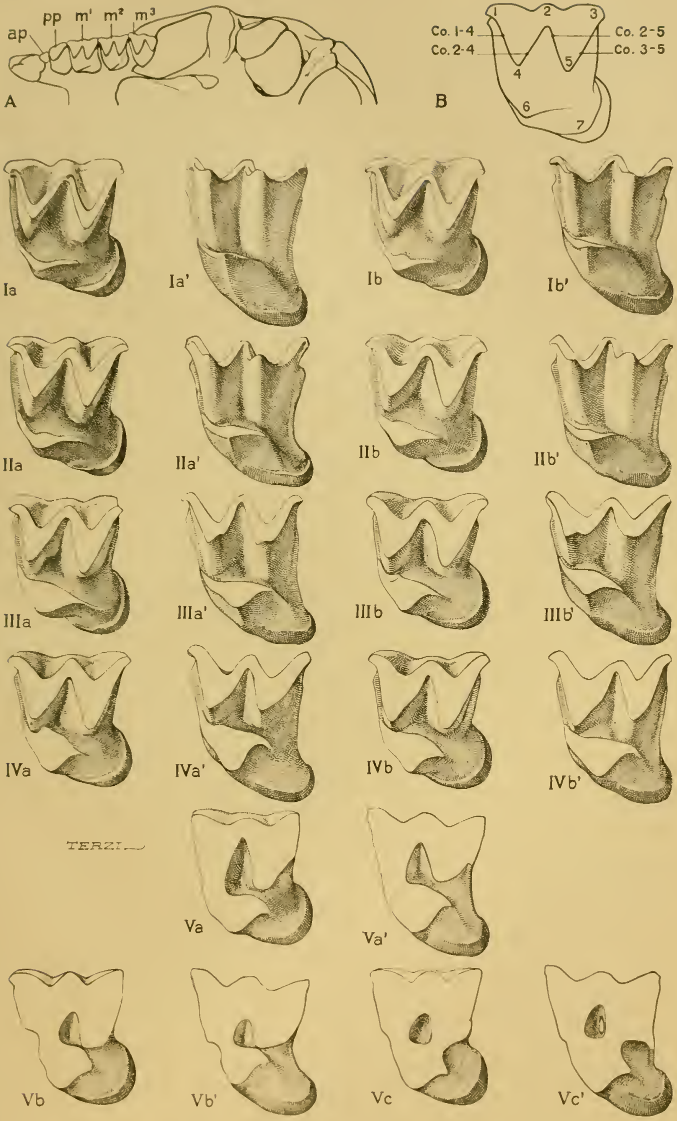
Fig. A.—Palate view of left half of skull, to show dentition. *ap*, anterior premolar; *pp*, posterior premolar; m^1, first, m^2, second, m^2, third molar. About 2·8 times natural size. (♀ ad., Seringapatam, S. Mysore, 18th October, 1912, G.C.S. 1943).

Fig. B.—Anterior upper molar, left side, enlarged, to explain structure. *1*, *2*, and *3*, the three cusps of the outer row; *4* and *5*, the two cusps in the middle row; *6*, inner cusp; *7*, heel. The commissures are marked *co*; *co. 1-4* is the commissure between cusps 1 and 4; *co. 2-4*, the commissure between cusps 2 and 4; and so on. (Same specimen as fig. A.)

Fig. I.—First stage of wear (individuals about 6 months old). *a* (surface view) and *a′* (inner side view) represent the minimum of wear found in this stage (♀ ad.; Seringapatam, S. Mysore, 18th October, 1912, G.C.S. 1943). *b* and *b′*, maximum of wear in this stage (♂ ad. same place and date, G.C.S. 1949).

Fig. II.—Second stage (about 18 months old). *a* and *a′* minimum of wear (♀, Seringapatam, S. Mysore, 19th October, 1912, G.C.S. 1957). *b* and *b′*, maximum of wear (♀, same place, 18th October 1912, G.C.S. 1939).

Fig. III.—Third stage (about 2½ years). *a* and *a′*, minimum of of wear (♀, Seringapatam, 18th October, 1912, G.C.S. 1937). *b* and *b′*, maximum (♀, same place and date, G.C.S. 1934).


ap
pp
m¹
m²
m³
A
1
2
3
Co. 1-4
Co. 2-4
Co. 2-5
Co. 3-5
4
5
6
7
B
Ia
Ia'
Ib
Ib'
IIa
IIa'
IIb
IIb'
IIIa
IIIa'
IIIb
IIIb'
IVa
IVa'
IVb
IVb'
TERZI
Va
Va'
Vb
Vb'
Vc
Vc'

MENPES PRESS, WATFORD

Tooth wear as an indicator of age in RHINOLOPHUS.

Fig. IV.—Fourth stage (about 3½ years). *a* and *a'*, minimum of wear (♀, Seringapatam, 18th October, 1912, G.C.S. 1938). *b* and *b'*, maximum (♀, same place and date, G.C.S. 1944).

Fig. V.—Fifth stage (about 4½ years). *a* and *a'*, minimum of wear (♀, Seringapatam, 18th October 1912, G.C.S. 1940). *b* and *b'*, medium degree of wear (♀, same place, 19th October, 1912, G.C.S. 1951), *c* and *c'*, maximum (♀, same place, 18th October, 1912, G.C. S. 1945).

ON THE SO-CALLED COLOUR PHASES OF THE RUFOUS HORSESHOE-BAT OF INDIA (*RHINOLOPHUS ROUXI*, TEMM.).

BY

KNUD ANDERSEN, F.Z.S.

(*With Plates I and II.*)

It has long been known to Mammalogists that certain species of *Rhinolophus*, Oriental as well as Ethiopian, show an extraordinary variability in the colour of the fur. The extremes of these colour types, or "phases" as they have been called, are often so strikingly different, the one being dull mouse-brown, the other brilliantly orange-chrome without a trace of brown anywhere in the pelage, that one can hardly be surprised that they have in some cases been described as different species.* Such extremes are often represented among specimens from the same locality, and if the series obtained is large enough it will often show several intermediate "phases." No wonder that as soon as it was realized that all this was merely "individual variation," some authors refused altogether to consider the colour of the fur a character of taxonomic value in bats.

Rhinolophus is by no means the only genus showing colour varieties of this kind. More or less similar phases occur in many species of the allied genus *Hipposideros* (*e.g.* in the *commersoni*, *bicolor*, *speoris*, *galeritus* and *caffer* groups) ; further in *Asellia*, *Triænops* and *Rhinonycteris*, all of which are closely allied to *Hipposideros* ; again in *Nycteris*, and in some *Phyllostomatidæ*, *Emballonuridæ*, *Molossidæ*, and *Vespertilionidæ*. They may be found to exist also in other families of Chiroptera,—in any case it is evident that their occurrence is a rather common phenomenon in bats.

Hitherto nothing has been known of these phases beyond the mere fact of their existence. Whether they are seasonal, or whether the individual moults "true" to its phase during the whole of its lifetime, are questions which, so far as I am aware, nobody has attempted to answer. The scarcity of large, carefully dated and sexed series of skins sufficiently explains why nobody has felt tempted to attack the problem.

Owing to the fine work recently done by the collectors for the Bombay Natural History Society's Mammal Survey of India this scarcity of material no longer exists so far as certain Indian species of *Rhinolophus* and *Hipposideros* are concerned. And it happens that one of the Horseshoe-Bats most richly represented in the Survey collections, *viz.*, *Rh. rouxi*, is a species which exhibits the colour extremes in their strongest contrasts, and at the same time presents the widest range of intermediate phases. The number of skins of this bat thus far brought together during the progress of the Survey amounts to 98 ; in addition there are 18 specimens preserved in alcohol, and I have had six dated skins from other sources, giving a total of 122 specimens. All specimens are adult, representing every degree of wear of the teeth, from the practically unworn condition (" stage I," *i.e.*, individuals about six months old*) to the stage in which the crowns are worn down to the gums (" stage V, " four and a half year old individuals). 46 are males, 76 females. They were obtained in South Mysore (Seringapatam, 34); South Mahratha Country (Devikop, 12) ; various places in North Kanara (Gersoppa, Hulekal, Sirsi, Barchi, Dandeli, Potoli, Yellapur, 72); Savantvadi (Nerur, 3), and Konkan, (Asgani, 1),—places sufficiently close together to be regarded, even in the narrowest sense of the term, as one geographical district. They all belong to one subspecies, *Rh. rouxi rouxi*†, and all the Survey specimens (116) were collected by Mr. Guy C. Shortridge. It is one of the finest series of specimens of any form of *Rhinolophus* that has ever passed through my hands.

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* The Rufous Horseshoe-bat of India is a case in point. Kelaart's *Rhinolophus cinerascens* (Prodromus Faunæ Zeylanicæ, 1852) is the dark, his *Rh. rammanika* an intermediate, and his *Rh. rubidus* the orange "phase" of *Rh. rouxi* (see P. Z. S. 1905, ii, p. 99).

Although certainly large and varied enough to illustrate the remarkable variability of colour shown by *Rh. rouxi*, this series is on the other hand not complete enough to allow one to follow the changes in the fur through every month of the year, It was not, it should be remembered, collected for this special purpose, but simply as part of the general Mammal Survey of this portion of India. Only six months are represented in the series, *viz.*, October, November, January, February, April and May, that is, the cold season (about October to January and February) and the hot and dry season (February to May) are represented, whereas there is not a single specimen from the whole of the rainy season (June to September). As it is, however, the series is sufficiently complete to solve the principal problem, namely, what do these colour " phases, " this unparalleled variability in colour mean?

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* See my paper. " On the determination of age in Bats, " this Journal, *antea*.

† The distribution of *Rh. rouxi*, so far as it is as yet traceable, is as follows:—It is known from many places in Ceylon : in the Peninsula from the Nilgiri Hills in the south, through South Mysore, South Mahratha Country, North Kanara, Savantvadi, and Konkan, as far north as Bombay. Ceylon specimens are apparently indistinguishable from those from India proper, and I refer them all to the subspecies *Rh. r. rouxi* (with the necessary reservation that I have not yet had an opportunity of examining Temminck's types in the Leyden Museum). North of Bombay there is a big gap in the known distribution of the species, though whether it is a real breach in the area inhabitated by this bat, or merely a gap in our material, it is impossible to say. Passing north from Bombay we meet the species again in Masuri (Dehra Dun), Kumaon, Nepal, Darjiling and Bengal ; and further east it turns up again in South China (Anhwei, Lower Yangtse). Specimens from all these places (Masuri to Anhwei) are distinguishable as a subspecies (*Rh. r. sinicus*). It is possible, though by no means certain, that the two subspecies are connected with each other along the east coast of India, which has not yet been worked by the Survey.

The first question we have to settle, before trying to unravel the mystery of the colour phases, are naturally these :—When does this bat change its coat? Does it moult once or (as usual among Mammals) twice a year? And what is the new coat like? Does it show the same " individual variation " in colour as exhibited when glancing down the whole series of specimens before us?

Fortunately the material gives clear answers to these preliminary questions. *Rh. rouxi* moults twice a year, in this part of India in October and again in May, and in both cases the new fur is dark brown above, grey on the underside of the body,—the ordinary bat colour, or very much like the colour of a House Mouse.

Where then do the brilliantly orange and the intermediate phases come in? To give the facts at once, before entering into details, *these phases are due to a gradual*, and on the whole evidently rather rapid, *change of the colour of the full grown hair.*

In order to follow the changes of the coat and colours in detail we must now examine the appearance of the specimens month by month, so far as the material allows.

There are twenty-eight skins dated October (1912), all from one locality (Seringapatam, S. Mysore), and very nearly of the same date (18th and 19th); all are females and all fully adult* (epiphyses of metacarpals ossified); the actual ages of the individuals are as follows :—Five are about six months old, nine about eighteen months, five two and a half years, four three and a half years, and five four and a half years. For reasons explained below we must put the youngest generation ("bats of the year," six months old) on one side; they require special description. The remaining twenty-three specimens may conveniently be divided into two groups, those in the process of moulting (fifteen), and those which have just completed, or practically completed, their autumn change of coat (eight).

(1) Fifteen October individuals, aged from one and a half to four and a half years, showing various stages of moult from the old orange to the new dark brown coat.†—Three specimens (1935, 1936, 1940) exhibit the initial stages of the change of fur. They are nearly orange-rufous (II, 11, h to j ‡) above, approximately mars-

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* That is, full grown; which does not necessarily imply that they are all sexually mature) this is certainly not the case with the youngest class of individuals) those only six months old).

† Collector's numbers, G.C.S. 1934-1941, 1944—1946, 1951, 1959, 1961, 1964.

‡ All colours are determined from Ridgway's "Color standards and Color Nomenclature," Washington, 1912, and the references between parentheses are to the plates of that book.

yellow (III, 15, i) or ochraceous-orange (XV, 15') beneath. The new dark hairs appear on the back of the neck and anterior dorsum; on parting the fur of these regions of the upper side it looks, on a hurried inspection, as if the coat had dark bases to the hairs; the dark "bases" are in reality the new short dark-coloured crop of hair. On the underside the new grey coat appears on the throat, chest, anterior portion of flanks, and anal region, leaving the breast, belly, and posterior flanks mars-yellow or ochraceous-orange. One of these specimens (1935) is figured on pl. I, fig. 1. The twelve other October specimens of this group illustrate the gradual progress of the moult. The new dark brown (mouse-coloured) fur spreads on the upperside from the back of the neck forward, over the head, and backward, over the middle of the dorsum, so that the last remnant of the old orange coat is, as a rule, an orange stripe along each side of the rump, next to the membranes (as in specimen 1944, figured on pl. I, fig. 3); at the same time the new grey hair of the underside spreads from the throat outward to the sides of the neck, and from the flanks and anal region mediad and forward over the belly, so that the last portion of the old mars-yellow coat to disappear is, in most individuals, a transverse stripe or crescent across the thorax (same specimen, pl. I, fig. 3).

(2) Eight October specimens (same ages as above) showing the completed moult.*—These are in new coat without trace or with only very slight traces of the old. The pelage of the upperside is roughly dark brown (approaching clove-brown, XL, 17''', m), but faintly powdered with greyish, owing to the extreme tips of the hairs being of this colour, and the base of the fur is again paler; the underparts are nearly uniform mouse-grey (LI, 15'''''). One (1958) is figured on pl. I, fig. 4.

Let us pause for a moment to consider what these two groups of October specimens have taught us. In the first place, we have seen that this bat has an autumn moult †, which, at least in this part of India, takes place in October; we must, of course, even within the same province, allow for some variation of the exact date; some individuals may begin moulting already late in September, others perhaps as late as early in November, though of this there is no direct evidence in our material. Secondly, the old orange fur is replaced not by a new orange coat, but by a coat of dark brown and grey (mouse-coloured) hair. What happens to this new very plain-coloured coat we shall see in a moment, but first we must examine the bats of the year.

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* Collector's Numbers, G.C.S. 1954-1958, 1960, 1962-1963.

† It seems to me unnecessary to change these terms, "spring moult" and "autumn moult," "summer coat", and "winter coat" when dealing with a tropical Indian mammal. The moults (in this bat) in fact take place very nearly at the same time of the year as in temperate climates, and the terms can hardly cause any confusion.

(3) Five October specimens, aged about six months.*—One of these individuals (No. 1949) is perhaps the most interesting in the whole Survey series of this species. It is a bat of the year which (1) has already completed its first autumn moult, and (2) happens to have been killed while it was changing the colour of this new coat from dark brown into auburn above, and from mouse-grey into ochraceous-tawny beneath. That this individual is in its first adult coat, not in the coat of the immature, is evident for two reasons:—The coat is new and fresh, not old and worn, as it would obviously be, if it were the baby coat; and anybody familiar with the peculiar dull testaceous tinge of the coat of the immature *Rh. rouxi* will see at a glance (although the colour is already, even where it is darkest, somewhat affected by the change into a brighter "phase") that it is not the tinge of the immature pelage. But the second statement, *viz.*, that the hair, in the moment the bat was killed, was changing colour undoubtedly needs strong evidence to be accepted. Some reader looking at the figure of this individual on pl. II (fig. 5) might say:—"What I see is a specimen which (speaking of its upperside only) is roughly half auburn and half brown; why then is this not an individual like those of group one above, that is, an individual in moult?" There are at least three reasons why this is not so; each of them would be sufficient in itself, and the combination of them therefore certainly places the matter beyond reasonable dispute. Firstly, if it were moulting it must either be moulting from the auburn into the brown phase (like the older October individuals, under group one, above, though those individuals were, of course, not auburn but orange), or *vice versa*; there are no other alternatives. If it were moulting from an auburn to a brown coat, it would follow that the auburn coat was the old one, *i.e.* (remembering it is a bat in its first autumn) the baby coat; but in all my work with Horseshoe-Bats (now extending over a series of years during which I have handled thousands of specimens belonging very nearly to every form known) I have never yet come across a single immature specimen in bright (auburn or orange) coat; whenever an auburn or orange specimen turned up, it was always adult; at least so far as *Rhinolophus* and *Hipposideros* are concerned, the bright phase may safely be said to occur only in the adult. Turning then to the other alternative, that this individual might have been moulting from a brown to an auburn coat, we find it negatived by the facts already pointed out above, that the brown hairs are not old and worn, but (even though examined under a dermatoscope) as new and unabraded as are the auburn, and that the brown tinge of these hairs is certainly not that of the coat of the immature. Secondly, if this bat were moulting, it must, judging

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* Collector's Numbers, G.C.S. 1943, 1947-1950.

from the fact that the auburn and brown areas are about equal in extent, be only about half-way through the moult, and in that case we should find somewhere in the fur evidence of new hair coming up, shorter than the rest; but there is no evidence whatever of this kind, all the hairs are full grown, all of their proper length, there is on the whole surface of the animal not a single spot showing a new crop of hair. Thirdly, the moult, as we have already seen (October specimens, group one, above), proceeds along definite lines, the new fur of the upperside first appearing on the back of the neck, spreading outward to the sides of the neck and backward along the median line of the dorsum, so that the last portion of the old fur to disappear is an orange stripe on each of the back and rump along the lateral membrane (see figs. 1, 2, and 3). A glance at fig. 4 will show how entirely differently our specimen behaves, both above and beneath. For these reasons there can be no doubt that our specimen was killed while changing the colour of its new full grown coat. This result is further supported by an examination of the four other individuals of this group, all of which are of the same age. The change of colour is in all four carried a good deal further than in No. 1949, is in fact *nearly* completed. The upperside is approximately auburn (II, 11, m) above, this colour gradually lightening to cinnamon (XXIX, 15″) toward the base of the hair, while the underside is ochraceous-tawny (XV, 15′, i). But the change is only "nearly" completed; there is still, in all four examples, a conspicuous amount of greyish colour on the throat (this disappears, as we shall see, in the following month), and in one specimen (1948) there is a small patch of grey left on the belly.

To the conclusions derived from groups one and two of the October individuals (see above) we can now add those obtained by our examination of group three, *viz.*, (1) Bats of the year undergo an autumn moult, like the older individuals; (2) this new coat is quite similar to the new coat of older individuals, dark brown above, mouse-grey beneath; (3) but this new coat (at least in the individuals we have seen thus far) when fully developed changes its colour into auburn above, ochraceous-tawny beneath; (4) this colour change probably takes place comparatively rapidly.

Even if we had never seen the five October specimens of "group three" we should have been forced to the conclusion that shortly after the autumn moult the colour of the new coat *must* change. We have seen that when orange specimens moult in October they put on a mouse-coloured coat. But we shall find that already in November (and then throughout the "winter") plenty of auburn and orange specimens occur. How could this fact be explained, otherwise than by a change of colour of the fullgrown hair?

We are now evidently well on the way to a better understanding of the colour phases in this bat, and can proceed to examine more closely the specimens from the next following months, as far as our material goes.

The November series (twelve skins *) shows some further brightening of the colours. The darkest individuals (♀ ad., No. 138, age, about a year and a half, figured on pl. II, fig. 6; ♂ ad., No. 139, about six or seven months) are very similar to the auburn October specimens just described, except in so far as the last traces of grey on the throat and belly have now disappeared, having been changed into ochraceous-tawny. In the most advanced November individual (♂ ad., No. 174, six to seven months old) the colour of the whole of the upperside has brightened into light Sanford's brown (II, 11, j) or hazel cinnamon-rufous (XIV, 11′, j) toward the base of the fur; that of the underside into a tinge approaching ochraceous-orange (XV, 15′, h). Better than by any description the difference between these two November extremes will be appreciated by comparing the patterns "auburn" with "Sanford's brown" and "hazel" on plates II and XIV of Ridgway's "Color Standards," and "ochraceous-tawny" with "ochraceous-orange" on plate XV. The nine other November skins fit in between these extremes.

I have seen no specimens from December, but twenty-four skins in the Survey collection show the appearance of the fur in the month of January.† One individual (♂ ad., Dandeli, No. 556, probably about nine months old) has remained very nearly in the auburn phase (see October and November, above), the only tangible difference being that the "auburn" of the upperside is perhaps a tone paler (more approaching to argus-brown, III, 13, m), and the ochraceous-tawny of the underparts a faint shade lighter. Several skins are similar to the brightest November individual described above. But the majority exhibit more advanced stages of colour modifications (see pl. II, fig. 7). The head and upperside are orange-rufous or a shade paler still (II, 11, i and h), brightening to orange-chrome (II, 11) at the base of the hairs; the underparts between ochraceous-orange and yellow-ochre (XV, 16′). The palest individual of all (♀ ad., Potoli, No. 522, about nine months old, figured on pl. II, fig. 8) has the upperside nearly xanthine-orange (III, 13, i or h), the underparts pale yellow-ochre (XV, 17′, a). It is closely approached by some other specimens from January, and practically exactly matched by the single skin from February

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* Four adult males, eight adult females; Devikop, S. Mahratha Country; November 21st and 25th; ages, from about seven months to three and a half years; Collector's Numbers, G. C. S. 134, 137-141, 174, 177-181.

† Seven adult males, seventeen adult females: Barchi, Dandeli, and Potoli, three places situated quite close to Supa, North Kanara; Jan. 18th, 19th, 21st and 28th, ages, from about nine months to about two years and nine months; Collector's Numbers, G. C. S. 519, 520, 522-529, 540-548, 556-558, 563, 564.

(♂ ad. Yellapur, N. Kanara, 20th February, B. M. O. 4. 1. 8, about one year and nine months old) and by several from April.

Individuals which have passed into this brilliantly orange colour phase no doubt remain there till the "spring" moult. As stated above, the only February skin I have seen is in this phase; from March no skins are available; but I have before me a long series from April, a considerable number of which are as bright-coloured as the brightest January specimens. It is probable, however, that shortly before the next moult sets in (May) the colours lose a little of their gloss and brightness. I have unfortunately no "spring" specimens moulting from the orange into the dark mouse-coloured phase, but October specimens changing from orange to dark pelage exhibit this slightly duller appearance of the old orange coat.

Such are the colour changes from October to April-May *in individuals which run through all phases.* But a very important fact I now have to call attention to. Although the individuals which pass through the whole scale of colour changes are decidedly in the majority in my dated material (the whole of which, it should be remembered, is from the region of the Peninsula between S. Mysore and the Konkan), *a certain*, and by no means small, *percentage of specimens stop short at an intermediate phase* (never, throughout the half-yearly period here under consideration, passing beyond that stage), *while others can even hardly be said to pass into any bright phase at all*, the coat being subject only to a rather ordinary fading of its colours. I will deal with these two categories of specimens separately:—

First, individuals remaining at an "intermediate" colour phase.—The first phase into which the freshly moulted (mouse-brown and mouse-grey) October coat passes is (as we have seen above) the auburn phase. We found already in October some individuals which were either on the point of changing the colour of the coat into auburn or had practically completed this change, and I took this as evidence that this colour change must take place rapidly; further, we found the fully developed auburn phase in the November series. But, as mentioned above, there is in the Survey series from January, that is, at a time when most individuals have passed into a bright orange phase, one individual (a nine months old male, No. 556) which has remained in the auburn stage; and there is in the British Museum collection another skin from January (♂ ad., Sirsi, North Kanara, Jan. 11, 1900, No. O.4.1.6, about nine months old) in exactly the same phase. Even much later in the season the auburn phase is met with. The April series numbers thirty-four, and of these four are auburn, while a few others are only a little more advanced. There is no doubt, therefore, that some individuals remain in the auburn stage throughout the whole season.

Secondly, individuals which hardly assume any bright phase at all.—In the British Museum is a skin from January (♂ ad., Sirsi, North Kanara, Jan. 11, 1900, No. O. 4.1.7, about one year and nine months old) which has not even entered the auburn stage. And in the large April series there are nine of which the same may be said* If these ten skins are placed along with the freshly moulted, "mouse-coloured" October individuals, it is easy to see that the colour has certainly altered to some extent. The upperside has in six specimens turned from the original rather dull mouse-brown (finely powdered with greyish) into a warmer brown tone, somewhat approaching to sepia and bister, and the originally greyish bases of the hairs have acquired a slight ecru tinge; further, the under parts are no longer mouse-grey, but rather drab-grey (XLVI). In the four remaining specimens the brown of the back is distinctly "diluted" or "washed" with a pale yellowish tinge, but not sufficiently so to alter the general brown total impression of the colour; and the tinge of the underparts is a decidedly warmer drab (not quite as bright as "avellaneous", XL). None of these could truly be described as belonging to the first, auburn phase, while on the other hand the colour is decidedly altered slightly in the direction of that phase.

That some specimens retain this colour right up to the spring moult is proved by two of the three May specimens before me. These two are the only individuals showing the spring moult. One is roughly bister, the other of a warmer brown above, but not auburn. The new fur is exactly like the fresh October fur in colour.

Not a single specimen is available from the whole period June-September. But that the "summer" coat passes through a series of colour phases similar to those described for the "winter" coat, is hardly open to doubt, if we remember the fact that the October material contains numerous individuals moulting from the orange phase into the dull mouse-brown.

One very curious fact remains to be mentioned. It is not only the fur that changes its colour, *even the claws, those of the feet as well as that of the pollex, partake in these changes.* The details are as follows :—

In all the specimens moulting from the orange to the mouse-brown phase (October) the claws are of the usual transparent horn-colour, without a trace of any other tinge. In the next colour stage of the fur, the auburn phase, the claws are either unchanged, or they begin to show a distinct deep reddening at the tips. In this phase we often find one or two claws of a foot unaltered in colour, while the others begin to change into deep blood-red. As a rule the claws of the feet are affected a little earlier than that of the pollex. Finally, in the orange phase of the fur, we find invariably the claws red. The colour always starts at the tips of the claws, spreading backward, though it is comparatively seldom that it reaches right to the exposed bases of the claws. The tinge is a beautiful blood colour, totally different from the original colour of the claws ; it looks as if the claws had been dipped in blood, sometimes the tips only, often for half their length or more. It will be noticed that the colour changes of the claws progress *pari passu* with those of the fur :—never any red in the claws in the non-orange phases, but the more brilliant the orange of the fur, the more extensive the red colour of the claws. The red colour is not superficial, but goes right through the horny substance.

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* The April material (34 skins, 31 of which belong to the Indian Survey collection) therefore shows the following colour stages :—9 brown (ages, one to three years), 8 auburn or a little beyond (one to three years), 17 orange (one to three years).

The colour changes in the full grown hair described above are perhaps without true parallels in the whole class of Mammalia, outside the order of Chiroptera. There are, of course, numerous instances of even very remarkable fading of colours. One of the cases which no doubt would most readily occur to the minds of British Mammalogists is the very striking and somewhat rapid change of colour in the tail of the British Squirrel*. But I fail to see any real parallel in that case. What happens in the Squirrel's tail is a fading from seal-brown through gradually paler tinges of brown to pale buff or nearly white ; in other words, a gradual dilution, and finally complete or almost complete disappearance, of *all* pigment in the hairs of the tail. In *Rh. rouxi* (and probably in other bats with similar phases) the pigment does not disappear, but (as we shall see in a moment) it gradually, though rapidly, changes from one colour into a totally different one. There may be (in fact, I believe there are) better parallels among birds. Every ornithologist will know of scores of cases of alleged colour change (without moult) in full-grown feathers, but I am not aware of any case in which the *whole* of the plumage of a bird (like the whole of the pelage of *Rh. rouxi* and many other bats) is affected by the change.

Together with my friend Mr. Martin C. Hinton (who is engaged in investigations of the hair structure of certain Rodents), I have examined the hair of *Rh. rouxi* microscopically. The pigment consists of minute granules arranged in longitudinal rows so as to produce a striated appearance of the hair (magnification, 710 diameters). In the newly moulted, mouse-coloured fur (dorsal region, specimen No. 1955) the colour of the pigment is some tinge of olive; in the bright phase (dorsal region, specimen No. 520) *this colour of the pigment has changed to orange.* How this change is effected is, of course, a question for the bio-chemist, but it appears probable that it is due to oxidation. If this is so, one may perhaps hazard the hypothesis that in individuals which show no colour change of this kind, or which stop short at an intermediate (auburn) phase, the oxidizing element may either be entirely absent or wholly or partly counteracted by some other factors.

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* Oldfield Thomas. The seasonal changes in the Common Squirrel ; The Zoologist, November 1896, pp. 401-407.

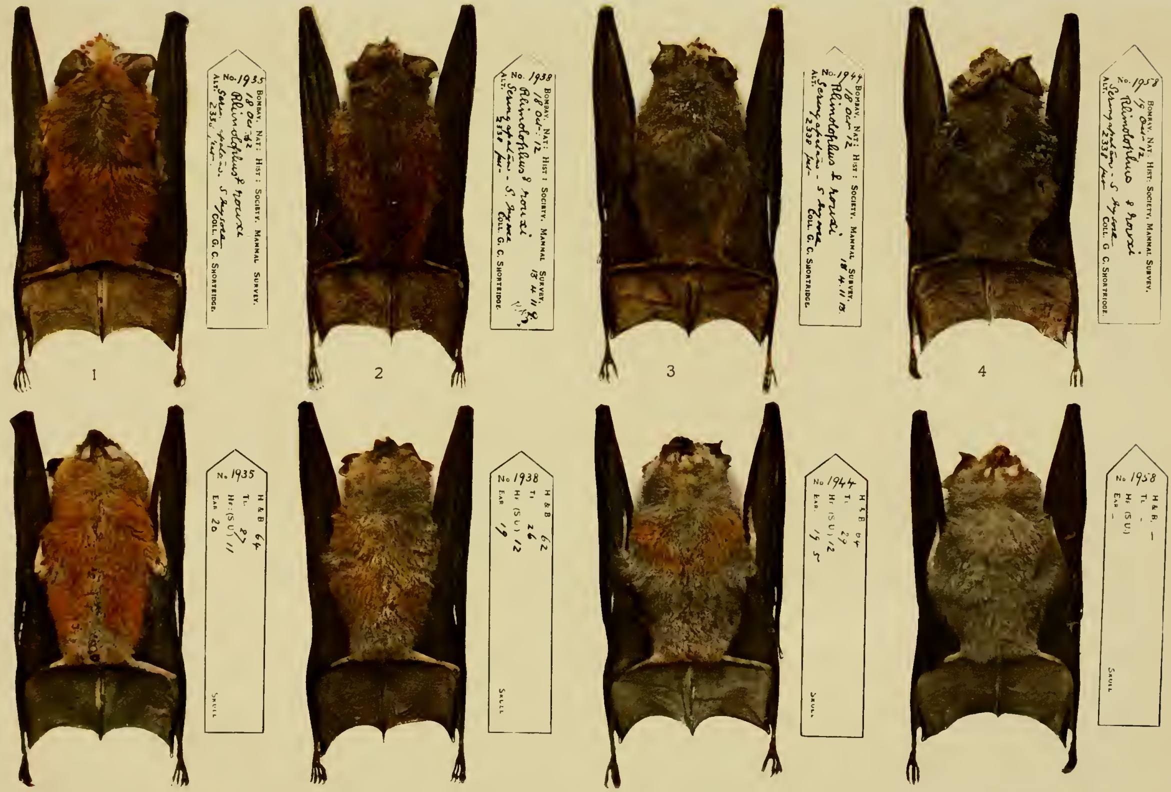
Summary.

(1) The coat of the young *Rhinolophus* (any species) is darker (duller, more matt) than that of the adult. I have seen very few immature individuals of *Rh. rouxi*, but those examined are of this dark and dull tinge. An immature individual in the bright (auburn, orange) phase I have never seen in any species of *Rhinolophus* or *Hipposideros*; it is improbable that the coat of the immature ever shows such colour.

(2) *Rh. rouxi* moults twice a year. In South Mysore and North Kanara the "spring" moult takes place in May, the "autumn" moult in October. Whether there is any considerable variation in the time (month) of the two annual changes of coat, either among individuals inhabiting the same geographical area, or between individuals from widely separated areas of India, are questions not answered by my material. The autumn moult is certainly complete (*i.e.*, affects the whole of the pelage). The same is probably the case with the spring moult, but the material available is very small (two examples only).

(3) The fresh fur, both in spring and autumn, is mouse-brown above, mouse-grey beneath.

(4) In a large number of individuals this colour of the new, full grown coat changes (probably rather rapidly) into much brighter tinges, the upperside through auburn and Sanford's brown to orange-rufous or even xanthine-orange, the underparts through ochraceous-tawny to ochraceous-orange or even yellow ochre. This explains the enormous "individual variation" in colour in this species (as it no doubt explains similar or corresponding colour variations in other bats). In autumn the colour change takes place immediately after the moult, in October and November; the exact time when it occurs in the spring coat is not shown by my material but it will probably be found to be in May and June. Every hair of the coat, and the whole of every hair, from tip to base, is affected by the colour change.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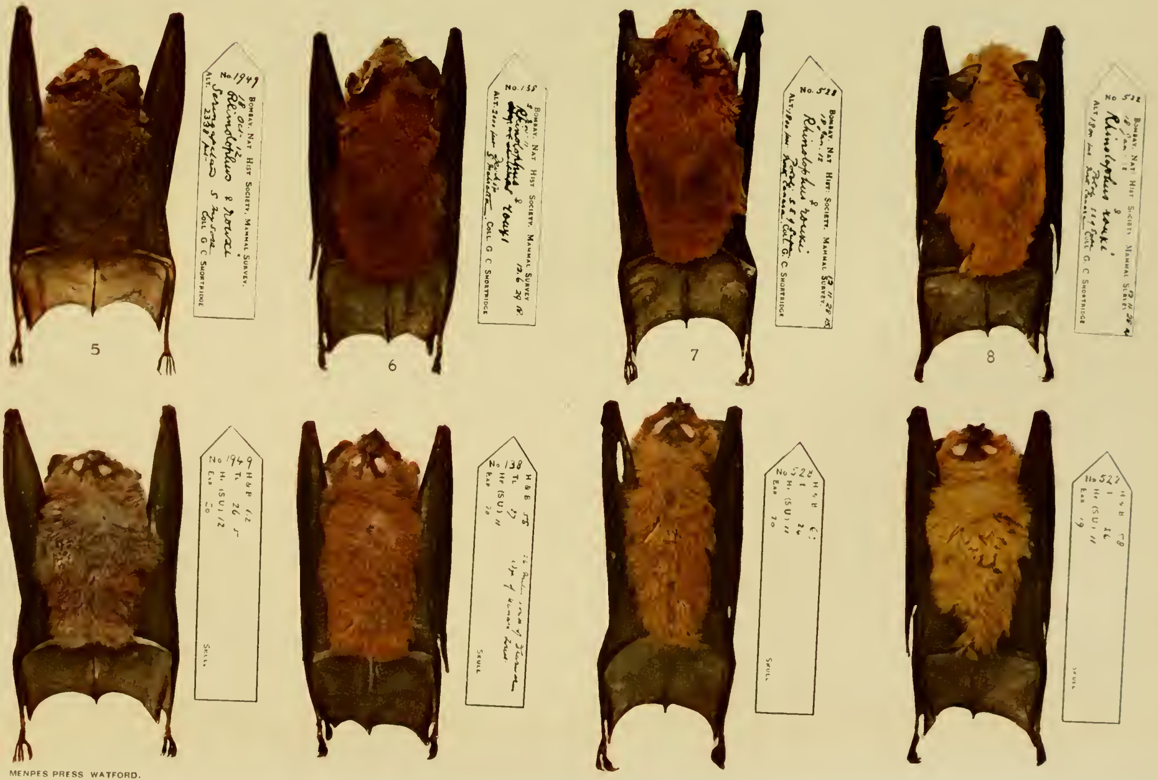
Bombay. Nat: Hist: Society. Mammal Survey.
18 Oct-12
Rhinolophus ♂ rouxi
Seringapatam. S Mysore
Alt. 2338 feet
Coll. G. C. Shortridge.
1
No. 1938
Bombay. Nat: Hist: Society. Mammal Survey.
18 Oct-12
13 4 11
Rhinolophus ♂ rouxi
Seringapatam - S. Mysore
Alt. 2338 feet
Coll. G. C. Shortridge.
2
No. 1944
Bombay. Nat: Hist: Society. Mammal Survey.
18 Oct 12
18 4. 11 13.
Rhinolophus ♂ rouxi
Seringapatam - S Mysore
Alt. 2338 feet
Coll. G. C. Shortridge.
3
No. 1958
Bombay. Nat. Hist: Society. Mammal Survey.
19 Oct-12
Rhinolophus ♂ rouxi
Seringapatam - S Mysore
Alt. 2338 feet
Coll. G. C. Shortridge.
4
No. 1935
H & B 64
Tl. 27
Hf: (S U) 11
Ear 20
Skull
No. 1938
H & B 62
Tl 26
Hf (S U) 12
Ear 19
Skull
No. 1944
H & B 64
Tl 29
Hf (S U) 12
Ear 19 5
Skull
No. 1958
H & B. –
Tl –
Hf (S U.)
Ear –
Skull

MENPES PRESS, WATFORD.

Colour changes in RHINOLOPHUS ROUXI.


No. 1949
Bombay. Nat Hist Society, Mammal Survey.
18 Oct. 12
Rhinolophus ♀ rouxi
Seringapatam S Mysore
Alt. 2338 ft
Coll G C Shortridge
5
No. 135
Bombay. Nat Hist Society. Mammal Survey
Rhinolophus ♀ rouxi
12.6 29 18.
Alt. 2000 feet
Coll. G C Shortridge
6
No. 528
Bombay. Nat Hist: Society. Mammal Survey.
19 Jan. 12
Rhinolophus ♀ rouxi
Alt. 1800 feet
Coll. G. C. Shortridge
7
No 522
Bombay. Nat Hist Society Mammal Survey
18 Jan. 12
Rhinolophus ♀ rouxi
Alt 1800 feet
Coll G. C Shortridge
8
No 1949
H & B 62
Tl 26 5
Hf (S U) 12
Ear 20
Skull
No 138
H & B 58
Tl 27
Hf (S U) 11
Ear 20
Skull
No 528
H & B 61
T 24
Hf (S U) 11
Ear 20
Skull
No 522
H & B 58
T 26
Hf (S U) 11
Ear 19
Skull

MENPES PRESS WATFORD.

Colour changes in RHINOLOPHUS ROUXI.

(5) Not all individuals pass through the whole scale of colour changes. A not inconsiderable number would seem to remain in the auburn stage; such individuals have been obtained not only in October and November (when we should naturally expect them), but also in January and April, together with specimens showing the extreme of the orange phase. Others show an even more limited "colour plasticity," the colour of the upperside changing only into sepia or bister, with or without a distinct yellowish "wash," the underparts into drab-grey. Such individuals are represented in the material from January, April, and May (moulting).

(6) The claws (feet and pollex) change colour together with the fur turning from transparent horn brown to deep blood red. The degree of colour change of the claws seems to be directly proportional to the degree of colour change of the fur; *i.e.*, the dark brown phase shows no colour change in the claws, this begins only with the auburn stage, and reaches its maximum (both in the intensity of the tinge and in the area of the claws affected by the change) of the bright orange phases. The red colour invariably shows first at the tip of the claw, spreading toward its base.

(7) The change of colour of the fur is due to a change of colour in the pigment (from olive to orange), probably owing to oxidation. The fact that some individuals exhibit no colour phases at all, while others remain in an intermediate phase, may be due to absence of the oxidizing element or to some factor which wholly or partly neutralizes this element.

Explanation of plates.

By the "four colour process" employed it has only been possible to give an approximately correct idea of the true colours of the specimens figured.

All figures are about 3/5 natural size.

Fig. 1. ♀ ad., 18 October 1912, Seringapatam, S. Mysore, G.C.S. 1935, age, three and half years. Autumn moult beginning. The fur on the back of the neck and shoulder is purposely disarranged, to show the new dark coat coming up underneath (it looks in the figure, and, on hurried inspection, in the specimen as well, as if the orange hairs had dark bases; this is not the case; the orange fur is always uniform to its extreme base, or if anything lighter at base; what looks like dark bases is, of course, the new dark coat). The orange fur, being old and worn, has lost some of its brilliancy. Back between Sanford's brown and orange-rufous (II, 11, j), underparts nearly ochraceous-orange (XV, 15′) with the new mouse-grey coat beginning to appear on throat, flanks, and anal region.

Fig. 2.—Same sex, date, place, and age as foregoing, G. C. S. 1938. Autumn moult well advanced. Old orange fur chiefly

confined on upperside to sides of back, on underside to chest and part of belly, though the new fur, both above and below, is still thinly sprinkled with old orange hairs. Several stages connecting those represented by figs. 1 and 2 have been seen, all from October.

Fig. 3.—Same sex, date, place, and age as foregoing, G. C. S. 1944. One of the final stages of the autumn moult. Old orange pelage now restricted on upperside chiefly to a narrow stripe on each side of the dorsum, along the lateral membranes, and on underside to a V-shaped patch on the chest ; new fur on back still with a very thin admixture of old orange hairs ; on belly a few tiny bunches of ochraceous-orange hairs among the new grey hairs. Several stages between " Fig. 2" and " Fig. 3" are in the collection, all from October.

Fig. 4.— ♀ ad, 19th October 1912, same place, G. C. S. 1958, age, about a year and a half. Moult practically completed (faint traces of orange hairs behind the ears and on chest, but these are discernible only on very close examination). Upperside mouse-brown, *i. e.* a dark shade of brown approaching clove-brown (XL) or fuscous (XLVI), but finely powdered with greyish owing to the narrow grey tips to most of the hairs, these greyish tips being longest and most conspicuous on the shoulders and back of the neck ; base of fur paler ; underparts nearly uniform mouse-grey (paler than LI, 15 '''''). Similar specimens from October are in the collection, but none from any other month. The new " summer " fur (May) is probably of the same colour, but only specimens in the first stages of the spring moult have been seen.

Fig. 5.— ♀ ad., 18th October 1912, same place, G. C. S. 1949, age, about six months. A perfectly full grown bat of the year (epiphyses of the metacarpals ossified). It had completed its first autumn moult, and was killed while the colour of its new coat was changing from mouse-brown to auburn above, and from mouse-grey to ochraceous-tawny on the underside of the body. This individual has been so fully dealt with in the text (p. *8*) as to need no further description here. Notice the entirely different "pattern" of this specimen, both above and below, as compared with the moulting individuals, figs. 2 and 3.

Fig. 6.— ♀ ad., 21 November 1911, Devikop, S. Mahratha Country, G. C. S. 138, age, about a year and a half. To show the perfectly developed auburn phase. There is now no trace of mouse-brown or mouse-grey in the coat. Upperside pale auburn (very nearly auburn Sanford's brown, II, 11, 1), gradually lightening (almost to cinnamon, XXIX, 15'') toward the base of the fur ; underparts warm ochraceous-tawny (XV, 14', i). This phase begins to make its appearance immediately after the autumn moult, in October, but specimens from that month (five from Seringapatam,

S. Mysore) are either only half auburn (one, see fig. 5), or have at least some grey colour left on the throat, or both there and on the belly (the others). In the November material (Devikop, S. Mahratha Country) the full auburn phase, as figured here, without trace of mouse-colour, is absolutely predominant; and the same phase occurs, though (so far as the material goes) much more sparingly, in the later months of the season. The summer fur (after the spring moult in May) will probably be found to have its corresponding auburn phase, but material from that season is lacking.

Fig. 7.—♀ ad, 18th January 1912, Potoli, S. E. of Supa, North Kanara, G. C. S. 528, age, about one year and nine months. To show an average tinge of the orange phase. Upperside almost orange-rufous (closely approaching II, 11, i), the tinge being slightly brighter and more glossy (II, 11, h) at the concealed base of the hairs; underparts almost ochraceous-orange (XV, 15′ or 16). No specimens comparable with this have been seen from the month of October (except, of course, those moulting from the orange to the dark phase, in which, however, the orange has lost considerably in brilliancy): a few individuals from November (S. Mahratha Country) approach it but do not quite match it in hue; no December specimens are available; in January this type of colour (or even brighter hues) is decidedly predominant and remains so till April and May, though in the latter month (spring moult) it has probably as a rule lost some of its brightness and gloss. The fact that the October series contains a good number of orange individuals in moult shows that the summer fur also has its orange phase.

Fig. 8.—Same sex, date, and place as fig. 7, G. C. S. 522, age, about nine months. The palest extreme of the orange phase. Upperside nearly xanthine-orange (III, 13, i or h), underparts pale yellow ochre (XV, 17′ a). Quite or approximately similar individuals have only been seen from January to April. The summer fur of some individuals may change into similar hue.

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON.

REPORT NO. 28. KALIMPONG (DARJILING).

BY R. C. WROUGHTON.

COLLECTION ... ... No. 28.
LOCALITY ... ... Kalimpong (Darjiling).
DATE ... ... June-October 1916.
COLLECTED BY ... ... N. A. Baptista.
EARLIER REPORTS .. .. No I, East Khandesh, Vol. XXI, p. 392, 1912; No. 2, Berars, Vol. XXI, p. 820, 1912; No. 3, Cutch, Vol. XXI, p. 826, 1912; No. 4, Nimar, Vol. XXI, p. 944, 1912; No. 5, Dharwar, Vol. XXI, p. 1170, 1912; No. 6, Kanara, Vol. XXII, p. 29, 1913; No. 7, Central Provinces, Vol. XXII, p. 45, 1913; No. 8, Bellary, Vol. XXII, p. 58, 1913; No. 9, Mysore, Vol. XXII, p. 283, 1913; No. 10, Kathiawar, Vol. XXII, p. 464, 1913; No. 11, Coorg, Vol. XXII, p. 486, 1913, No. 12, Palanpur, Vol. XXII, p. 684, 1913; No. 13, South Ceylon, Vol. XXII, p. 700, 1913; No. 14, Shan States, Vol. XXII, p. 710, 1914; No. 15, Kumaon, Vol. XXIII, p. 282, 1914: No. 16, Dry Zone, Central Burma and Mt. Popa, Vol. XXIII, p. 460, 1915; No. 17, Tenasserim, Vol. XXIII, p. 695, 1915; No. 18, Ceylon, Vol. XXIV, p. 79, 1915; No. 19, Bengal, Vol. XXIV, p. 96, 1915; No. 20, Chindwin, Vol. XXIV, p. 291, 1916; No. 21, Gwalior, Vol. XXIV, p. 309, 1916; No. 22, Koyna Valley, Vol. XXIV, p. 311, 1916; No. 23, Sikkim, Vol. XXIV, p. 468, 1916; No. 24, Sind, Vol. XXIV, p. 749, 1916; No. 25, Chin Hills, Vol. XXIV, p. 758, 1916; No. 26, Darjiling District, Vol. XXIV, p. 773, 1916; No. 27, Bhutan Duars, Vol. XXV, p. 63, 1917.

On completion of his work in the Bhutan Duars, reported in No. 27 (J., B. N. H. S., XXV., p. 63, 1917), Baptista, the Society's Collector, moved on to Kalimpong, where Dr. Sutherland had consented to supervise his movements. The present collection represents his work there during five months, June-October, 1916.

Unfortunately no notes on the topography are available, but I gather from the Gazetteer that Kalimpong is a tract in the Darjiling District, situated at about 27° N. Lat. and 88°30′ E. Long., east of the Tista River, west of Ni-chu and Di-chu, and bounded by Bhutan on the north. The tract is made up of a series of steep ridges and the valleys between, and is largely under trees. The area is just over 400 sq. miles, of which slightly more than half is Reserved Forest, situated on the tops of the ridges and the bottoms of the valleys, *i.e.*, above 5,000′ and below 2,000′.

The fauna seems to be identical with that of Darjiling and the

Bhutan Duars, but the collection, though a fairly large one in numbers, has not a wide range in species.

In all there are some 560 specimens divided among 29 species and subspecies), in 22 genera.

There is nothing new to the Survey list in the collection, but the series of *Nyctalus* and *Barbastella* are most welcome, as so far only single specimens had been obtained.

(1) ROUSETTUS LESCHENAULTI, Desm.

The Fulvous Fruit Bat.

(Synonymy in No. 11.)

Pedong, ♂ 1 (juv), ♀ 5.

(*See* also Reports Nos. 15, 16, 17, 22 and 27.)

(2) RHINOLOPHUS ROUXI, Temm.

The Rufous Horse-shoe Bat.

(Synonymy in No. 5.)

Nimbong, ♂ 6.

(*See* also Reports Nos. 6, 9, 13 and 15.)

(3) RHINOLOPHUS MONTICOLA, K. And.

The Mussoorie Horse-shoe Bat.

(Synonymy in No. 20.)

Nimbong, ♂ 2, ♀ 12; Pedong, ♀ 1; Sangser, ♂ 3.

(4) HIPPOSIDEROS ARMIGER, Hodgs.

The Great Himalayan Leaf-nosed Bat.

(Synonymy in No. 14.)

Nimbong, ♀ 2.

(*See* also Reports Nos. 15, 16, 20, 25 and 26.)

(5) HIPPOSIDEROS FULVUS, Gray.

The Bicoloured Leaf-nosed Bat.

(Synonymy in No. 3.)

Nimbong, ♂ 5, ♀ 12; Sangser, ♂ 6, ♀ 9.

(*See* also Reports Nos. 3, 5-10, 12-14, 16-20, 22-24 and 27.)

(6) BARBASTELLA DARJELINGENSIS, Horsf.

The Eastern Barbastel.

(Synonymy in No. 26.)

Nimbong, ♂ 6, ♀ 12.

(*See* also Report No. 27.)

(7) TYLONYCTERIS FULVIDA, Blyth.

The Club-footed Bat.

(Synonymy in No. 26.)

Kalimpong, ♂ 6, ♀ 15; Nimbong, ♂ 1; Sangser, ♂ 1.

(*See* also Reports Nos. 14, 17, 20, 23 and 25.)

(8) NYCTALUS LABIATUS, Hodgs.

The Indian Noctule Bat.

Sangser, ♂ 2, ♀ 8.

This animal at first sight looks like a *Scotophilus*, but is at once recognisable by the very short fifth finger. A naked spot between the shoulders is so constantly present as to be a character of almost specific value.

(9) PIPISTRELLUS COROMANDRA, Gray.

The Coromandel Pipistrel.

(Synonymy in No. 5.)

Nimbong, ♂ 2, ♀ 1; Pedong, ♂ 12, ♀ 26; Kalimpong, ♂ 2, ♀ 1; Sangser, ♂ 1.

(*See* also Reports Nos. 2, 5, 9, 11, 13-15, 19, 23, 26 and 27.)

(10) MURINA TUBINARIS, Scully.

Scully's Tube-nosed Bat.

(Synonymy in No. 25.)

Sangser, ♂ 3.

(*See* also Report No. 26.)

(11) MURINA CYCLOTIS, Dobs.

The Round-eared Tube-nosed Bat.

(Synonymy in No. 23.)

Sangser, ♂ 1.

(*See* also Reports Nos. 25 and 26.)

(12) TUPAIA BELANGERI CHINENSIS, And.

The Assam Tree Shrew.

(Synonymy in No. 23.)

Nimbong, ♂ 2.

(*See* also Report No. 27.)

(13) SORICULUS CAUDATUS, Horsf.

Hodgson's Brown-toothed Shrew.

(Synonymy in No. 15.)

Sangser, ♀ 2.

(*See* also Reports Nos. 23, 26 and 27.)

(14) PACHYURA SP.

The Musk-rat.

Kalimpong, ♂ 15, ♀ 26; Nimbong, ♂ 2; Pedong, ♂ 5, ♀ 5; Sangser, ♂ 1.

(*See* also Reports Nos. 1, 3-7, 9-13, 15-19, 22, 23, 26 and 27.)

(15) FELIS AFFINIS, Gray.

The Jungle Cat.

(Synonymy in No. 1.)

Nimbong, ♀ 1.

(*See* also Reports Nos. 3-7, 10-12, 15, 16, 18-20, 22, 24 and 27.)

(16) FELIS (*domestic*).

Pedong, ♂ 1.

(17) VIVERRA ZIBETHA, L.

The Large Indian Civet.

(Synonymy in No. 14.)

Nimbong, ♂ 1, ♀ 1.

(*See* also Reports Nos. 20, 23, 25, 26 and 27. Nos. 14 and 17, separated as sub-species *pruinosa*.)

(18) CANIS INDICUS, Hodgs.

The Bengal Jackal.

(Synonymy in No. 5.)

Pedong, ♂ 1, ♀ 1.

(*See* also Reports Nos. 14-16, 19, 20, 23, 25 and 27.)

(19) MARTES FLAVIGULA, Bodd.

The Northern Indian Marten.

(Synonymy in No. 15.)

Pedong, ♀ 1.

(*See* also Reports Nos. 20, 23, 25 and 27.)

(20) LUTRA LUTRA, L.

The Common Otter.

(Synonymy in No. 11.)

Pedong, ♀ 1. (no skull.)

(*See* also Reports Nos. 15, 18 and 23.)

(21) RATUFA GIGANTEA, McCl.

The Assam Giant Squirrel.

(Synonymy in No. 14.)

Sangser, ♂ 2, ♀ 1.

(*See* also Reports Nos. 23 and 26.)

(22) TOMEUTES LOKROIDES, Hodgs.

The Hoary-bellied Himalayan Squirrel.

(Synonymy in No. 23.)

Nimbong, ♂ 1; Sangser, ♀ 2.

(*See* also Reports Nos. 23 26, and 27.)

(23) VANDELEURIA DUMETICOLA, Hodgs.

Hodgson's Tree Mouse.

(Synonymy in No. 16.)

Kalimpong, ♂ 1.

(*See* also Reports Nos. 23, 25, 26 and 27.)

(24) MUS DUBIUS, Hodgs.

The Nepal House Mouse.

(Synonymy in No 15.)

Kalimpong, ♂ 18, ♀ 28; Nimbong, ♂ 1; Pedong, ♂ 5, ♀ 12.

(*See* also Reports Nos. 23, 26 and 27.)

(25) Mus homourus, Hodgs.

The Himalayan House Mouse.

(Synonymy in No. 15.)

Kalimpong, ♂ 6, ♀ 2; Nimbong, ♂ 2, ♀ 1; Pedong, ♂ 12, ♀ 14; Sangser, ♂ 1, ♀ 1.
(*See* also Reports Nos. 23, 26 and 27.)

(26) Mus pahari, Thos.

The Sikkim Hill Mouse.

(Synonymy in No. 23.)

Pedong, ♀ 1 (juv); Sangser, ♀ 1.
(*See* also Report No. 26.)

(27) Rattus fulvescens, Gray.

The Chestnut Rat.

(Synonymy in No. 15.)

Nimbong, ♂ 2, ♀ 1; Pedong, ♂ 1, ♀, 2.
(*See* also Reports Nos. 14, 17, 23, 25 and 26.)

(28) Rattus nitidus, Hodgs.

Hodgson's Grey-bellied Rat.

(Synonymy in No. 15.)

Kalimpong, ♀ 1; Nimbong, ♂ 6, ♀ 1; Pedong, ♂ 1, ♀ 1, Sangser, ♂ 3, ♀ 3.
(*See* also reports Nos. 23 and 26.)

(29) Rattus rufescens, Gray.

The Common Indian Rat.

Variety with white underside:—

Kalimpong, ♂ 17, ♀ 14; Nimbong, ♂ 28, ♀ 31 Pedong, ♂ 30, ♀ 21; Sangser, ♂ 18, ♀ 14.

(30) Gunomys bengalensis, Gr. and Hardw.

The Bengal Mole Rat.

(Synonymy in No. 19.)

Kalimpong, ♂ 1, ♀ 6; Nimbong, ♂ 5, ♀ 9.
(*See* also Reports Nos. 20, 23, 26 and 27.)

LIVERWORTS OF THE WESTERN HIMALAYAS AND THE PUNJAB, WITH NOTES ON KNOWN SPECIES AND DESCRIPTIONS OF NEW SPECIES.

BY

SHIV RAM KASHYAP, M.Sc. (Punjab), B.A. (Cantab.),

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II.

MARCHANTIALES—(concluded).

(*Continued from page 350 of Vol. XXIV.*)

Fimbriaria reticulata, n. s. Diœcious. Thallus yellowish green, thin, unbranched, upto 6 mm. long and 4 mm. broad, obovate with a deep notch at the apex. Margins entire. Dorsal surface flat. Stomata not prominent, each bounded by one ring of 6-7 cells; air chambers empty in two layers. Ventral surface greenish; scales purple ovate, appendage ovate entire. Midrib broad, elliptic—oblong in transverse section, slightly projecting ventrally, rather suddenly passing into the wings. Carpocephalum—stalk naked reddish at base upto 4½ mm. long; receptacle flat, stomata only slightly raised sporogonia upto 4; pseudo-perianth hyaline, ⅔ exserted. Spores, elaters and antheridia not seen. The apical part of the thallus in sterile plants becomes narrowed and thickened, and persists in this condition through the dry period.

Habitat.—Kashmir, 8,000 ft. in a shady place along the road.

Plagiochasma simlensis, n. s. Diœcious or monœcious. Thallus closely creeping, bluish green, branched, upto 15 mm. × 4 mm. Margins entire or slightly crenulate. Dorsal surface smooth, plane; stometa not at all prominent, very small, pore minute bounded by 4 or 5 cells; upper epidermis thin walled, trigones small. Ventral surface purple; scales overlapping, triangular, entire, appendage not sharply constricted off from the body, purple or hyaline. Transverse section of the thallus biconvex in the middle gradually thinning towards the margins. Female receptacle sessile or shortly stalked (stalk when present upto 2 mm.), concave dorsally. Sporogonia 1 or 2. Spores broadly reticulate-lamellate; margin spinulose; about 112 u. Elaters closely 3-4-spiral, broad large, occasionally branched, 340-400 u. Male receptacles in a middorsal row, either on different lobes of the thallus bearing female receptacles or on different plants, cushion like, circular or notched anteriorly.

Habitat.—Simla, below Chota Simla, near a small stream, August. The "æstivation" of the involucre is similar to that of other species described by the writer before, (New Phytologist, Vol. XIII, No. 9). one valve being folded and the other being fully opened out.

Jungermanniales.

Riella indicast., n. s. Plants submerged erect or ascending, firmly fixed to the mud by rhizoids, often in dense patches, light green, simple or once or twice forked, upto 10 mm. long. Often many branches are given off from the base and plants have a tufted habit. Wing well developed in early stages upto 2 mm. broad; in the fertile portion small and interrupted, lateral leaves long and narrow, linear, conspicuous. Involucres upto 6 on each plant, densely situated, cylindrical pointed upto 2 mm. long, cells papilliform. Spores reticulate spinous, 7-8 reticulations in the diameter, spines conspicuous projecting beyond the margins.

Habitat.—In shallow water in a water-channel of the Shalamar garden. Lahore; occasionally on damp mud.* The plants were found in the months of February and March of 1913 and 1914. This is the first species of Riella to be described from India.

Aneura Indica st. n. s. Thallus simple or irregularly pinnately branched, or forming rosettes, loosely attached to humus, or firmly fixed to the soil; lobes thin or thick, margins undulate, slightly raised, or closely attached to the substratum. Lobes up to 3 cm. long and up to 5 mm. broad. No distinct midrib, thallus gradually thinning towards the margins. Greatest thickness in the middle from 8 to 13 cells. Dorsal epidermis, smooth or papillose or epidermal cells dome-shaped. Diœcious. Male plants smaller, irregularly branched, branches rather long and narrow, thick fleshy, margins turned upwards. Antheridia on small branches with a circular outline, restricted to the central part of the dorsal surface.

Archegonia with filamentous or small flat green scales.

Habitat.—Various parts of the Himalayas and the plains.

Common on the hills, rare in plains. Extremely variable. In moist shady places the plants remain thin and light green only loosely attached to the substratum, and epidermal cells of the dorsal surface are plain; in exposed warm places of the plains the plants are thick deep green firmly attached to the soil, and the cells of the dorsal epidermis are projecting into distinct papillæ. The dorsal epidermal cells of the male plants are perhaps always papillate. Occasionally archegonia occur on the dorsal side of elongated shoots, mixed with small multicellular papillate outgrowths. Normally in the genus *Aneura* the female shoots remain very small.

Aneura Levieri Schffr. Plants brownish, densely overlaping in thick patches, very much branched in an irregularly pinnate manner, up to 10 mm. long. Lobes liner or linear oblong, ultimate branches quadrate or obovate; oblong or linear in very moist places. No distinct midrib. Main shoot up to eight cells thick, biconvex lenticular in transverse section; cells all alike or epidermal cells rather small.

Habitat.—Chamba-Chuari road, 6,000 ft. on a moist cliff. Pangie in running water. The Pangie specimens were much longer up to 25 mm. but the older parts were dead. They were also thinner and the ultimate lobes were oblong or linear oblong.

Metzgeria pubescens (Schrank) Raddi. Mussoorie about 5,000 ft. Chamba-Pangie road, about 10,000 ft.

The chief interest of this species lies in its great variation. The plant can be readily recognised owing to the presence of setæ on both surfaces everywhere. The European specimens, however, are described as distinctly pinnate with 8 to 11 cells forming the epidermis of the midrib. The Pangie specimens were more or less pinnate but the number of epidermal cells on the midrib was 6 or 7. The Mussoorie specimens were distinctly dichotomous and the number of epidermal cells on the midrib was only 4. In other respect the plants resemble the European forms.

Metzgeria Himalayansis n. s. Plants deep green, dichotomous upto 15 mm. or more long and upto 1 mm. broad. Lobes upto 4 mm. long. Midrib biconvex, lamina plane or undulate, occasionally interrupted. Long hairs present on the undersurface of the midrib and the margins, the rest naked. Midrib 4-5 cells thick and 3 cells broad through the centre. Epidermal cells $\frac{2}{2}$. Lamina in old parts upto 14 cells on each side; cells 32 u. × 24 u.

Calycularia crispula, Mitt. Dalhousie-Chamba road; Garhwal, near Gauri Kund.

Pellia calycina (Tayl). Nees. Common in the Himalayas; Simla, Mussoorie, Murree, Pangie, Garhwal.

Fossombronia himalayensis, Kashyap. (New Phytologist, XIV, No. 1). Mussoorie; Chamba-Pangie road; Simla. The wingless terminal stalk-like portion bearing the tuber at the apex often divides into two branches each bearing one tuber exactly as in *Sewardiella tuberifera* (see below). July-September.

Sewardiella tuberifera, Kashyap. (New Phytologist, XIV, No. 1). It may be taken to be a condensed form of *Fossombronia himalayensis*. July-September.

N.B.—The leafy *Jungermanniales* will be taken up later on.

Anthocerotales.

Anthoceros himalayensis, Kashyap. (New Phytologist, Vol. XIV, No. 1).

Habitat.—Many parts of the Himalayas; Simla; Mussoorie; rarely on the banks of the Ravi in Lahore. Plant growing under water or where they are constantly moistened by dripping water do not form the characteristic tubers. July-September. (In Lahore about March).

Anthoceros erectus, Kashyap. (New Phytologist, Vol. XIV, No. 1). Mussoorie, Simla. July-September.

Anthoceros chambensis n. s. Thallus closely creeping firmly fixed to the soil, in dense circular or irregular patches, lobes often overlapping, margin toothed slightly raised upwards. Patches upto 3 cm. or more in diameter. Lobes thick fleshy with large mucilage cavities inside; greatest thickness in the middle upto 16 cells; upto 1 cm. broad. No distinct midrib. Epidermal cells 32 m. × 20 m. Rhizoids mostly smooth, some granular. Diœcious. Involucre tubular narrowed above, with truncate mouth; 2·5 mm. Sporogonia 2·5 cm. long, solitary. Pseudo-elaters thin walled usually branched, upto 100 u. long, slender. Spores opaque faintly granular, 40-48 u. Male plants not seen.

Habitat.—Chamba-Chauri road, moist rock; sterile plants were also found by the late L. Bashambar Das near Sialkot.

Notothylas levieri, Schffr. Plants densely overlapping in small thick patches, ascending, fixed only at the base; patches projecting outwards from vertical rocks. Thallus thin, delicate, largest circular in outline upto 1 cm. in diameter; smaller plants usually obovate; margin lobed, lobes narrow, small, toothed; Nostoc colonies scattered. Greatest thickness upto 6 cells in the middle gradually thinning towards the margins. Dioecious. Sporogonia marginal between the lobes equal to or smaller than the full grown adjacent lobes, entirely within the involucres which often arise in pairs; upto 2 mm. long × ½ mm. broad. Epidermis without stomata; radial walls of epidermal cells very thick and brown, cavity very narrow; epidermal cells 90-110 u. × 18-20 u. Spores opaque dark brown, minutely granular, 36 u. Sterile cells with oblique curved thin bands or incomplete spirals, 45 u. × 22-40 u.

Habitat.—Simla; Mussoorie July-September.

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THE FEMALE OF THE DRAGONFLY, *BRACHYTHEMIS FUSCOPALLIATA* (Ris).

BY

CAPT. F. C. FRASER, I. M. S.

(*With a Plate.*)

The male has been described by Ris and also by Selys and Kirby under the synonyms of *Trithemis fuscopalliata* and *Cacergates fuscopalliata* respectively. The description by Ris in 1910 states that the female is unknown and his description of the male, made from dried specimens, is not complete. In March of this year, I took a fair number of specimens above Abadan on the Shat-el-Arab which were all males and a few days later secured four females at the mouth of a creek opposite Basra. They are very shy insects and keep well out in the stream, so that it was only by wading out up to the hips that the specimens were secured.

Male. (Amplified from the description by Ris.)

Expanse 58 mm. Length 38 mm. Pterostigma 2·5 mm.

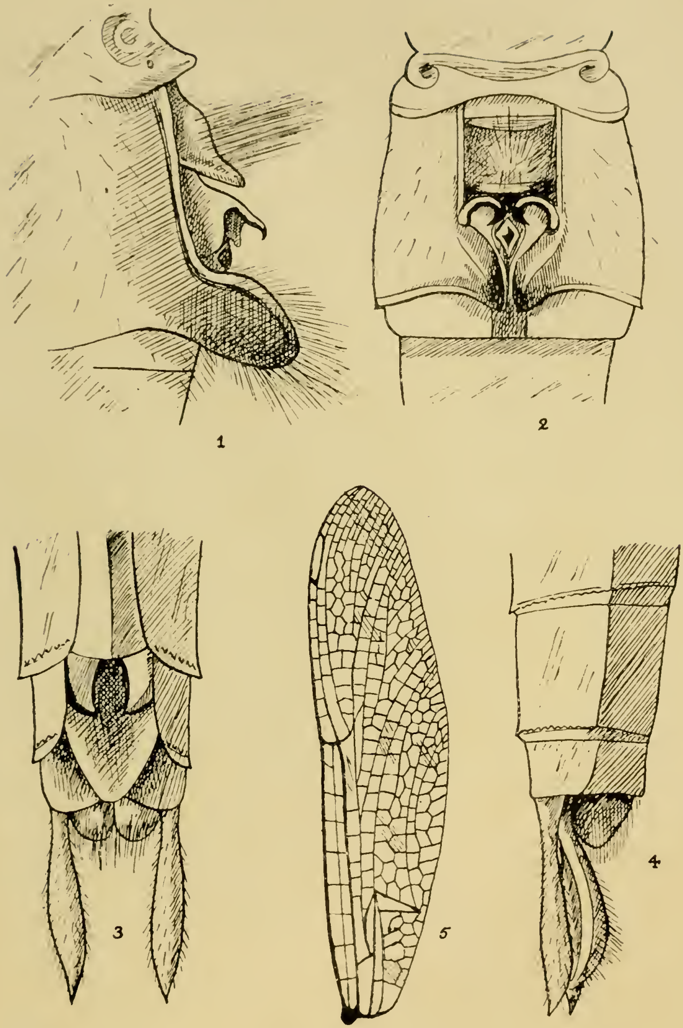
Head of moderate size: eyes contiguous for a very short distance, dark-brown, almost black above, sepia tint beneath: occipital triangle small, strongly rounded posteriorly: epistome strongly rounded, without a marked, free border: sutures practically flush: vesicle high and narrow, deeply notched above and in front: occiput, vesicle, and upper part of clypeus dark brown with a black streak across the lower part of the latter: labrum and labium yellow.

Prothorax hidden almost entirely beneath the head, the posterior lobe small and rounded. Black.

Thorax moderately robust, downy with a ruff of longer hairs along the dorsal anterior border which meet and interlace with a ring of ciliæ projecting backward from the rim of the occipital cavity. Colour uniformly black with a patch of ferruginous at the attachment of the wings on the side. *Legs* fairly long, black, the outer surfaces of tibiæ striped with yellow. Femoræ 3, with a row of stout spines gradually lengthening from the middle: femoræ 2, similar but the spines fewer in number: tibial spines numerous, fine and moderately long: claw-hooks typical.

Abdomen short, tumid at the base, gradually tapering towards the extremity, depressed in the posterior $\frac{2}{3}$ and strongly keeled in the posterior $\frac{1}{2}$. 4th segment with a transverse ridge near the proximal end. (Ris' description has apparently been made from specimens distorted by compression in paper.) Uniformly black in colour.

Wings short and rounded, reticulation close, sub-trigone in forewing entire, or partially or entirely traversed by a strongly curved nervure. Antenodal nervures $6\frac{1}{2}$-$7\frac{1}{2}$ in the forewing, 5 in the hind: trigone in forewing entire: sectors of the arc in forewing fused throughout but a short distance, in hind throughout a long distance:



GENITAL ORGANS AND WING OF THE DRAGON FLY

Brachythemis fuscopalliata.

are in forewing about midway between antenodal nervures 1 and 2: one or two very incomplete rows of cells in the space between the subnodal sector and the supplementary sector of forewing. Stigma bright opaque yellow. Costa brown, reddish brown in its outer third. A broad, blackish-brown fascia crossing both wings from the base to 2 postnodal cells in the forewing and 3-4 in the hind, in which its free border slopes obliquely to meet the termen at about its middle.

Anal appendages.—Ochreous, the superior long, about or a little less than the length of 9th and 10th abdominal segments, pubescent, cylindrical and pointed. The inferior fused to form a triangular body, notched slightly at the extremity.

Sexual organs.—L. a. recumbent, on its surface two tufts of long, greyish ciliæ. Hamecons very small, anterior as two, small, strongly-arched, slim hooks; posterior, low and blunt: lobe moderately large, rounded and projecting somewhat more than the hamecons.

Female.—Morphology except for the anal appendages and sexual organs and a few points in the wings, similar to the male.

Head.—Eyes olivaceous with 2 dark-brown lines traversing them from above downwards, to half-way down the sides, the anterior ot these bands starting from the apex of the occipital triangle. Clypeus, epistome, vesicle, occiput and labium and labrum, all light greenish-yellow.

Prothorax lemon-yellow with two transverse, black streaks.

Thorax olivaceous-green with a triplicated humeral fascia: the thoracic spiracle and lateral sutures black.

Legs yellow, streaked in their length with black. Spines similar to male.

Wings.—Antenodal nervures $8\frac{1}{2}$-$7\frac{1}{2}$, the final one complete or incomplete, this lack of symmetry sometimes seen in the opposite wings of a single specimen, and some of the nervures often bifurcating in the costal space. Trigone in forewings traversed by one nervure; only one row of cells in the space between the subnodal sector and the supplementary nervure. The black fascia found in the male, entirely absent in the female: the antenodal nervures bright yellow as is also the pterostigma.

Anal appendages ochreous, tipped with black, widely separated, cylindrical, nearly as long as in the male, straight.

Sexual organs.—Vulvar scale, two triangular, stout organs, slightly separated with concave, opposing borders and a minute point at their extremities.

Abdomen olivaceous-green with a black, mid-dorsal line and a brown, subdorsal fascia: the edges, narrowly black. Extent of markings variable, in some these preponderating over the ground colour and in juvenile specimens, the latter preponderating.

Expanse 62 mm. Length 35 mm. Pterostigma 2·5.

THE CONE OF *SELAGINELLA PALLIDISSIMA*, SPR.

BY

S. L. GHOSE, M.Sc.,

Assistant Professor of Botany, Government College, Lahore.

(*With a plate.*)

In this paper the writer proposes to describe the cone of *Selaginella pallidissima*, not so much its internal structure as some points about its external morphology such as its size, and the form of its sporophylls, especially in relation to their protection of sporangia. Besides, a comparison between its sporophylls and those of the cones of some other species of the genus is attempted with regard to their protection of sporangia.

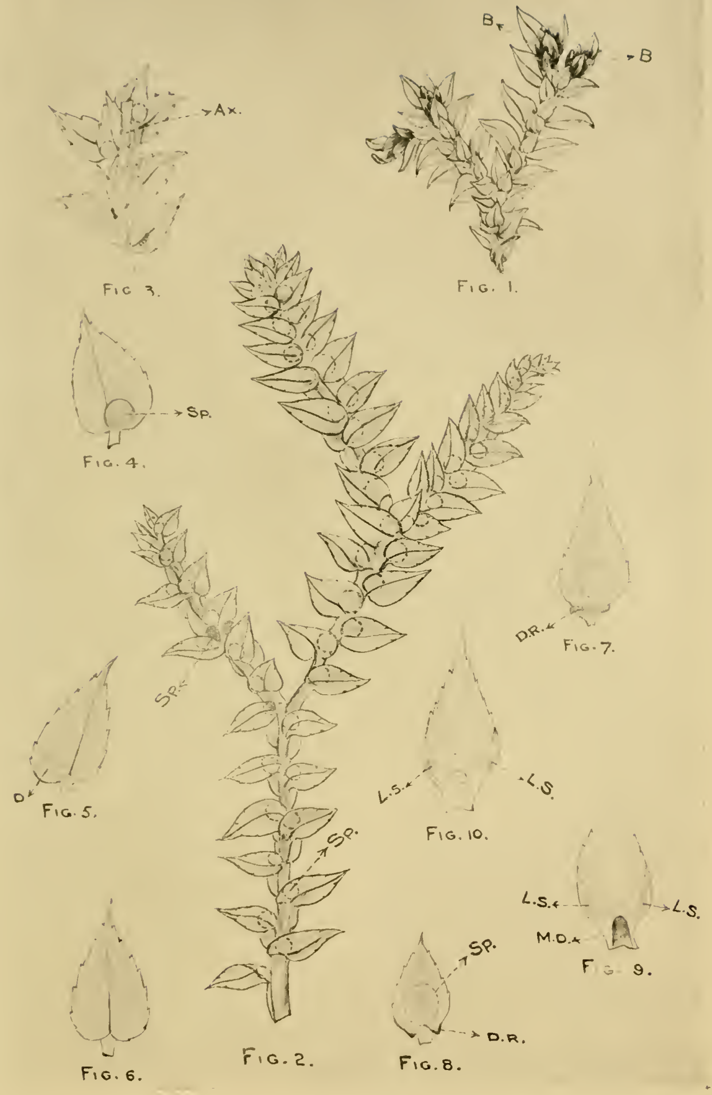
A paper on 'The Cones of the Genus Selaginella' was published in the 'Annals of Botany' in July 1910 by Miss M. G. Sykes and Mr. W. Stiles, where also the different kinds of sporophylls were described in relation to their protection of sporangia. but the peculiar conditions found in the species *S. pallidissima*, were not noted (9).

The material of *S. pallidissima*, *S. chrysocaulos*, and *S. chrysorrhizos* was collected by Professor Shiv Ram Kashyap of the Lahore Government College and the writer at Simla at a height between 5,000 and 7,000 feet above the sea level. Part of it was preserved in alcohol, and the rest dried up. *S. serpens*, *S. Emmeliana*, and *S. viticulosa* were obtained fresh from the Lahore Botanical Gardens. *S. spinosa*, *S. Martensii* and *S. kraussiana* were obtained as preserved material from England.

GENERAL.

Baker in his 'Handbook of the Fern-allies' puts the species *S. pallidissima* in the Sub-genus 'Homostachys', in which the ordinary leaves are of two kinds and spreading in two planes, and the 'bracts' also are dimorphous, the smaller 'bracts' being in the same plane as 'the smaller more ascending' leaves (1). There is only one more species, *S. ciliaris*, in the Sub-genus. The latter is found in Ceylon. Gœbel in his 'Organo-graphy of Plants' puts these two species in the group 'Platystachyeæ' with the 'first kind of flowers', the second kind of 'flowers' being 'inverse-dorsiventral' (5). He points out that in the second kind of 'flowers', 'the larger sporophylls which stand upon the upper surface of the axis form a protective cover to the whole flower, and this—as well as the increased capacity of assimilation established by these leaves—is, to speak teleologically, the reason why the sporophylls of the upper surface are different from the foliage leaves of the upper surface.' Thus he explains the rarity of the first kind of 'flowers' by assuming that the 'inverse-dorsiventral flowers' are more utilitarian. The wide occurrence of the species *S. pallidissima*, therefore, in the North-west Himalayas becomes quite interesting, especially when combined with some abnormal conditions in the cone, and the existence of peculiar vegetative buds at the tip of some branches.

The stem is much inter-matted, 8-15 cm. in length, and generally creeping, only the cones being ascending in position. The main stem is repeatedly forked, the branches being more or less alike. The consecutive leaves of the lower plane are placed at a distance of about 1·75 mm., and those of the upper plane at a distance of about 1·5 mm., from each other. Branched rhizophores are given off at each dichotomy of the stem. Most of the branches end in a short swollen bud (Fig. 1, B) while a few are not swollen at all at their tips. Miss Bancroft in her paper on 'Vegetative


B
B
Ax.
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L.S.
L.S.
M.D.
Sp.
D.R.

Fig. 3. Fig. 1. Fig. 4. Fig. 7. Fig. 5. Fig. 10. Fig. 9. Fig. 6. Fig. 2. Fig. 8.

THE CONE OF *SELAGINELLA PALLIDISSIMA*, SPR.
(*For Explanation of Figures, see end of article.*)

reproduction in some Indian Selaginellas' has described 'surface-tubers' in *S. chrysocaulos*, which provide for vegetative propagation in that species (2). The buds in *S. pallidissima* are much smaller, though quite as compact as those of *S. chrysocaulos*. The writer has not been able to find any beginnings of rhizophores in them, so that he cannot say whether or not these correspond to the 'surface-tubers' of *S. chrysocaulos*. He thinks that they might be of the nature of 'winter-buds' of the higher plants, which simply protect the growing apex from inclement weather.

THE CONE.

The cone generally forms a branched structure up to 5 cm. long (Fig. 2). Baker, however, gives ½-1 inch as the size of the cone (1). This is due, perhaps, either to his not recognizing the branched nature of the cone, or his examining only very small specimens. The branched nature is clearly proved by the presence of sporangia in the whole of the branched structure (Fig. 2). Besides, it is not uncommon to find individual fertile branches measuring about 3·5 cm. in length. The sporophylls are not situated very compactly on the axis, but are placed at a little distance—about ·6 mm. in the lower and ·75 mm. in the upper sporophylls—from each other, so that portions of the axis lying between the consecutive leaves are clearly visible through the upper sporophylls (Fig. 3, ax). The sporangia, as a rule, lie in the axil of the sporophylls of the lower plane only, the upper sporophylls being generally sterile. This peculiarity is very interesting, because as far as the writer could find out it is supposed that in the genus *Selaginella* each of the sporophylls, except sometimes the basal ones, has a sporangium in its axil. Miss Mitchell in her paper on 'The Anatomy of the Genus Selaginella' writes, 'The leaves,' meaning those of the cone, 'are hollowed to accommodate the sporangia which arise one in the axil of each leaf' (8). Bower in his book 'The Origin of a Land Flora' says: 'In fact its (of sporangium) position may vary in different species, though the numerical relation of one to each leaf is strictly maintained' (3). These assertions might mean that only *one* sporangium—*not two or more*—is found in the axil of each sporophyll, or that *each* sporophyll bears a sporangium in its axil. Miss Mitchell actually says that in the elongated cones of *S helvetica*, *S. Walichii*, *S. oregana* and *S. flabellata* the middle region is frequently sterile (8). Campbell, however, clearly writes on this point that 'the basal leaves of the strobilus may be sterile, but usually each sporophyll subtends a sporangium' (4). In all the species which the writer examined, except *S. pallidissima* each sporophyll did subtend a sporangium. The total absence of the sporangia from the axil of the upper sporophylls, therefore, becomes very characteristic.

The distribution of sporangia on the cone is usually indiscriminate, the megasporangia not always being confined to the basal regions. In number the latter are comparatively fewer than the microsporangia. A megasporangium on an average measures ·8 mm. across, and a microsporangium ·65 mm. along the long axis, the latter being 'saddle-shaped'.

Inequality in the size of mega-spores is also not uncommon, sometimes the whole cone having its megasporangia each containing two large and two small megaspores. The megaspore ordinarily measures about ·35 mm. across, but in cases of inequality of spores, the big megaspore measures about ·4 mm. and the small one about ·2 mm. in diameter. The microspore measures about ·01 mm. across. The colour of megasporangia is yellow and that of microsporangia brownish red.

The sporophylls are dimorphous and 'homostachous'. Those of the lower plane are ovato-cordate, erecto-patent, shortly ciliated and slightly imbricated, measuring about 1·7 mm. in length and 1 mm. in breadth (Figs. 4 & 5). The long axis of each sporophyll is at an angle of about 60° to that of the stem bearing it (Fig. 3). The sporophyll is clearly oblique; the half nearest the stem-axis is much bigger than the one away from it, and is besides much more lengthened out, and rounded at the base than the other half (Figs. 4 & 5). This stretched out portion partly goes under the stem-axis, and has a depression for lodging the sporangium. The rest of the sporophyll is quite flat and there is no dorsal flap or ridge at all as described by Sykes and Stiles in the species *S. pumila*, *S. helvetica*, and *S. caulescens* (9).

The sporophylls of the upper plane are cordate, patent, slightly ciliated and much imbricated (Fig. 6). Each is shortly stalked and measures about 1·3 mm. in length and 1 mm. in breadth; thus it is comparatively broader in form than the sporophyll of the lower plane. Its long axis is at an angle of about 30° to that of the stem (Fig. 3). It is quite flat and symmetrical and there is no dorsal flap or ridge.

The protection of sporangia is very characteristic in this species. They generally arise in the axils of sporophylls of the lower plane only. Each sporangium is lodged in the depression found in the stretched out basal part of the sporophyll as mentioned above. The upper surface of the sporangium is covered partly by the stem and partly by a portion of that half of the next higher sporophyll of the upper surface which is away from the axis. This is made possible by the sporophylls of the two planes being inserted at different angles to the stem-axis as noted above. The greater part of the upper sporophyll simply spreads over the stem, while the greater part of the lower ones spreads out free from the stem; thus the greater part of both kind of sporophylls is easily accessible to light for assimilation. The sporangium is placed between the overlapping portions (Fig. 3). In this way each sporangium is, as it were, enclosed, in a chamber formed by the basal parts of the lower and upper sporophylls and a portion of the stem. This form of sporangium-protection gives another reason why definite sterilizations are taken to be utilitarian. One reason is given by Miss Mitchell who says that these sterilizations 'make for the increased efficiency of the spore production as a whole' by preserving 'the balance between the spore producing and the vegetative parts' (8). The additional function of protecting the sporangia can also clearly be attributed to the sterile sporophylls of *S. pallidissima*. Here the laminas of two sporophylls, both practically flat, take part in the protection of one sporangium.

GENERAL CONSIDERATIONS.

The chief peculiarities in the cone of *S. pallidissima* can be summed up as its comparatively great size, branched nature, loose insertion of sporophylls, very little difference between the sporophylls and the ordinary vegetative leaves in structure and form, indiscriminate distribution of mega—and micro-sporangia, occasional inequality of size in mega-spores, saddle-shaped microsporangia, absence of sporangia from the axils of upper sporophylls, and the peculiar method of protection of sporangia by the sporophylls. The great size, branched nature, and loose insertion of sporophylls clearly show that the cone is not much highly advanced towards 'flower' formation. Indiscriminate distribution of mega—and micro-sporangia also tends to show the same according to Mitchell (8). A tranverse section of the stem shows that the species belongs to *S. Martensii* group of Harvey-Gibson, which is taken as a primitive form of stem structure in the genus *Selaginella* (6). The stem is mono-stelic and ribbon-shaped with two protoxylem groups, one at each end. Further, according to Sykes and Stiles the saddle-like shape of micro-sporangia also indicates the primitiveness of the cone (9). Then again, the 'homostachous' arrangement of sporophylls also proves the same fact (5). Thus it can be easily concluded that *S. pallidissima* is one of the simplest of the dorsiventral species of *Selaginella*. Sterilization of upper sporophylls, however, seems to show that the cone is not so primitive as it otherwise appears to be. The line of sterilization in this species is quite different from that of other species. Sterilization in other species begins from the base of the fertile branches and proceeds towards the apex; but in *S. pallidissima* sterilization takes place in the sporophylls of the upper plane only. In this connection it is interesting to note that Professor Kashyap informs the writer that he in very rare cases actually found one or two sporophylls of the upper surface having sporangia in their axils, forming as it were an intermediate stage. As already pointed out, this kind of sterilization is utilitarian, because it helps in the protection of sporangia besides preserving 'the balance between the spore producing and the vegetative parts.' This also explains the fact why the cone has a loose nature and is much bigger than that of most of the other species.

The peculiar arrangement for the protection of sporangia and specially the absence of any dorsal flap in the sporophylls becomes interesting in view of the assertion of Sykes and Stiles, who believe that the enfolding of the sporangia by the associated sporophyll is higher than the dorsal flap arrangement (9). For this purpose the cones of the following species were also examined to see the nature of dorsal flap in their sporophylls :—

I. Radial Cones —

   (*a*) *S. spinosa*, P. B. Aethog., has a very slight dorsal swelling.
   (*b*) *S. Emmeliana*, Van Geert., and *S. viticulosa*, Klot, have a slight dorsal ridge (Fig. 7).
   (*c*) *S. serpens*, Spr., has a better developed dorsal ridge with lateral prominences (Fig. 8).
   (*d*) *S. Martensii*, Spr., has better formed lateral projections on the dorsal ridge.
   (*e*) *S. kraussiana*, A. Br. (Figs. 9 & 10) has a very well formed dorsal flap, with a depression in the middle and a prominence at each side with a socket in each, in which the sporangium from below fits. The sporangium vertically below the sporophyll fits in the middle depression.

II. Dorsiventral Cones—

(*a*) In *S. chrysocaulos*, Spr., the smaller sporophylls, that is those of the lower plane, have a shallow depression at the base, and a big free dorsal transverse wing, a little notched in the middle. The bigger sporophylls or those of the upper plane are a little folded and have a long dorsal flap along its long axis, as figured in Goebel's 'Organography of Plants,' Vol. II, page 507 (5). Besides, each has a transverse dorsal ridge prominent at one side, namely, that under the stem. This little projection takes part in protecting the sporangium of the lower plane, situated just below the sporophyll. The sporangium is thus protected by the associated sporophyll, projecting from the higher sporophyll of the upper plane, and the dorsal transverse flap of the higher sporophyll, of the lower plane.

(*b*) *S. chrysorrhizos*, Spr., has the same conditions in the sporophylls as *S. chrysocaulos* except that the upper sporophylls have a better formed dorsal transverse ridge, and also that the lower sporophylls have a bigger dorsal flap with no notch in the middle.

It is interesting to note that according to Hieronymus these species make an ascending series (7). Thus the series of the radial cones would be arranged as *S. spinosa*, *S. Emmeliana*, *S. viticulosa*, *S. serpens*, *S. Martensii* and *S. kraussiana*: and that of the dorsiventral ones as *S. pallidissima*, *S. chrysocaulos* and *S. chrysorrhizos*. It has been seen that the above series show the serial grades in the development of the dorsal flap of the sporophylls. It seems probable, therefore, that the dorsal flap has been evolved over again, in the genus *Selaginella*, and not inherited from ancestors resembling *Lycopodium*, as suggested by Sykes and Stiles (9). It is quite possible that it is produced on account of the gradual compactness of the cone, and the consequent compression brought on the sporophylls. Besides, the better protection of sporangia obtained by the dorsal flap arrangement also suggests that the possession of a dorsal flap by the sporophylls is more advanced.

SUMMARY.

The cone of *Selaginella pallidissima* is a branched structure up to 5 cm. in length. The sporophylls are very little differentiated from the ordinary vegetative leaves and are inserted quite loosely on the axis, so that the cone does not at all form a separate compact structure. The sporophylls of the upper plane are quite sterile and only those of the lower plane have sporangia, one in the axil of each sporophyll. Mega—and micro-sporangia are distributed indiscriminately on the cone. Sometimes mega-spores are unequal in size. Microsporangia are 'saddle-shaped.'

The cone can be taken to be a very primitive one on account of its big size, branched nature, loose insertion of sporophylls, little differentiation of the latter from ordinary foliage leaves, and indiscriminate distribution of mega—and micro-sporangia on the axis. The absence of any dorsal flap or ridge on the comparatively simple sporophylls of *S. pallidissima* and a comparison of the more complex sporophylls of *S. spinosa*, *S. Emmeliana*, *S. serpens*, *S. Martensii*, *S. kraussiana*, *S. chrysocaulos* and *S. chrysorrhizos*, tend to show that the presence of the dorsal flap in the sporophylls of *Selaginella* is not primitive, but has been evolved in the genus.

The writer's cordial thanks are due to Professor Shiv Ram Kashyap for kindly allowing him to use his material and for many corrections and suggestions in the paper.

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Explanation of the Figures.

Figure 1—A small branch of *S. pallidissima* to show vegetative buds at B. (× by 5).

Figure 2—A whole branched cone of *S. pallidissima*, seen from the lower surface. Sp. sporangium. (× by 5).

Figure 3—A small portion of the cone of *S. pallidissima*, seen from above. Ax. stem-axis, seen through the upper sporophylls. (× by 8).

Figure 4—Left hand sporophyll of the lower plane of *S. pallidissima*. Sp. sporangium. (× by 20).

Figure 5—Right band sporophyll of the lower plane of *S. pallidissima*. D. depression for the sporangium. (× by 20).

Figure 6—Right hand sporophyll of the upper plane of *S. pallidissima*. (× by 20).

Figure 7—Sporophyll of *S. Emmeliana* seen from the dorsal side. D. R. dorsal ridge. (× by 20).

Figure 8—Sporophyll of *S. serpens*, seen from the dorsal side. (× by 20).

Figure 9—Sporophyll of *S. kraussiana*, seen from the dorsal side. M. D. middle depression ; L. S. lateral sockets. (× by 20).

Figure 10—Sporophyll of the same, seen from above. L. S. lateral sockets. (× by 20).

PRELIMINARY NOTES ON A RECENT BOTANICAL TOUR TO THE HIGH WAVY MOUNTAIN (S. INDIA).

BY

E. BLATTER, S. J., AND PROF. F. HALLBERG.

Early this year we asked Major Gage, the Director of the Botanical Survey of India, to suggest a spot which was not known botanically. It so happened that he was just touring in S. India, looking out for land suitable for cinchona plantations, and he had visited the higher levels of most mountains of S. India. He advised us to pay a visit to the High Wavy Mountain, provided we were ready to rough it. As to the latter point there was not the slightest reluctance on our part; but before we start on a tour, we always like to know, at least approximately, the geographical position of the country to be visited. So far we knew we had to go south; but this was about all. We consulted the Imperial Gazetteer, but the High Wavy Mountain was not to be found, and the sheets of the Atlas volume are not on a sufficiently large scale to contain many of those multisyllabic names of the Tamil language. We procured the latest Survey maps of S. India, and on one of them we came across the name of the High Wavy Mountain. But the contours were not given. There was only a blank space with the following words printed in it: "High Wavy Mountain, forming the source of the Shurly, overrun with dark impenetrable forest." That much at least was sure that the mountain in question was situated in the south-western corner of Madura District, on the frontier of Travancore. We expected more detailed information from the District Gazetteer of Madura; but we were sadly disappointed. The essence of all the information derived from it may be expressed in the Gazetteer's own words: "The High Wavy is the least known part of the hills of Madura, and is infested with elephants." If Major Gage had not indicated the route we had to take, I am afraid we should still be in search of the High Wavy Mountain. We left Bombay at the beginning of May, accompanied by Mr. Almeida, Assistant Professor of Biology at St. Xavier's College, who was expected to pay special attention to the ferns, Mr. Prater of the Bombay Natural History Society who was sent as collector for the Mammal Survey, and Mr. Vakil who intended to collect the fungi and lichens of that area. In Madras we made a last attempt to get a good map of the country we were to examine. All we were able to procure was the Madura District map (without hills) for the use of touring Officers. We continued our railway journey down to Ammayanyakkanur, perhaps better known under the name of Kodaikanal Road Station. Here we bought our provisions: a sack of rice, flour, salt, pepper, coffee and sugar. We had to do 60 miles in a bullock cart before we could expect to reach Kambam, a small town at the foot of the High Wavy. Our road first went due west to Periyakulam, a town south of the Palni Hills. From there we entered the Kambam Valley in a south-western direction, walled in on both sides by high precipitous mountains. To the right we had the continuation of the Palni Hills, the so-called Cardamom Hills, and to the left the Varushanad and Andipatti Range, an outlier of the Western Ghats. We did the journey in 24 hours, without a break. We were not sorry when we arrived at Kambam and were allowed to have a day's rest at the Forest Ranger's Office, which Mr. Jackson, the Conservator of Forests, had kindly put at our disposal.

To the east of Kambam a beautiful waterfall is visible in the upper third of a high mountain. This was pointed out to us as the river that drains the High Wavy. At last we had got a glimpse of the mountain that nobody seemed to know. It rose before us, steep and precipitous. We were told that a forest road leads up to the top, where a forest hut would be ready to receive us. We decided to start early next morning. But it was not going to be early, owing to the late arrival of the coolies. It was a stiff climb of ten miles in the scorching heat of the sun, with no food and with very little and bad water. All our scientific interest was gone and we did not care a straw for plants during those hours, and I made up my mind never to go in for botany in future. It was only later on during our descent that we noticed that the lower slopes are well covered with deciduous forest. The lower region contains a *Cycas*, one or two species of *Phœnix*, *Anogeissus latifolia*, *Adina cordifolia*, *Dalbergia paniculata*, *Pterocarpus marsupium*, *Schleichera trijuga*, and other marketable timber trees, and also the rare *Aquilaria agallocha*, the "scented eagle wood" of commerce. The upper part of the deciduous zone produces blackwood (*Dalbergia latifolia*), *Lagerstrœmia microcarpa*, and some teak of fair size. Above the deciduous zone there follows a belt of bare, rocky grass land. The top of the hill consists of an undulating plateau, perhaps 15 square miles in area, which is entirely covered with a continuous, dense evergreen forest which runs down in long irregularly shaped masses for a considerable distance into the valleys on either side. It was in this part of the mountain, at about 5,100 feet altitude, that most of us reached the forest hut towards sunset. We had to cross an elephant trench in order to reach it, and the two rooms were just big enough to accommodate our camp beds. As we wanted to make this hut our headquarters, the first thing to do was to make a time table and to fix on a menue. We decided to go out at daybreak, to return between 1 and 4 p.m., after that to press plants till sunset. The menu caused us very little trouble. There was no quarrel about the choice and sequence of the courses:

Early morning: Cafe noir with native bread.
Lunch: Rice and pepper sauce with café noir.
Dinner: Rice and pepper sauce with café noir.

It happened once or twice that Mr. Prater shot a giant squirrel, and when he had removed and bottled everything that science claimed, we were allowed to make a meal of the rest.

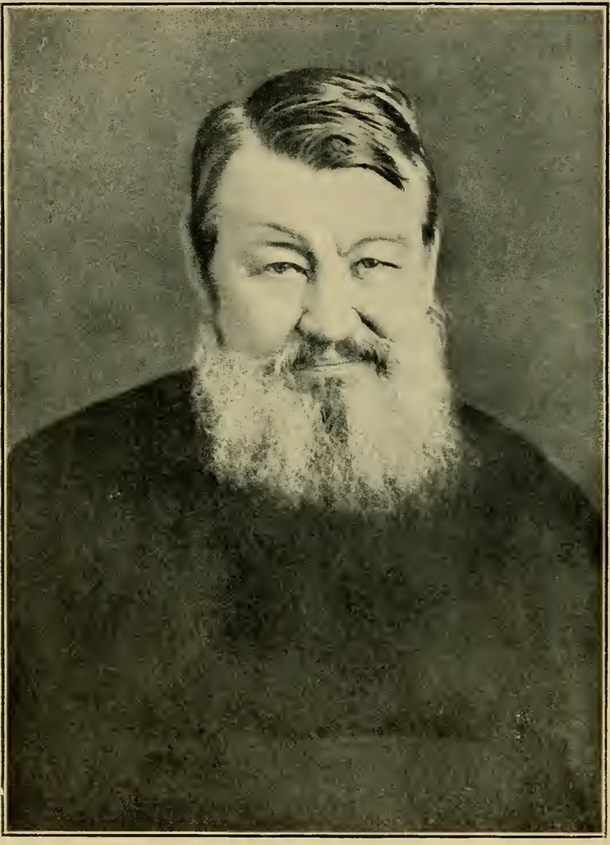
In spite of the meagre fare we have been able to make a complete botanical survey of the whole plateau, *i.e.*, of a belt between 4,000 and 5,500 feet. The Survey map speakes of a dark impenetrable forest. This is literally true. You are free to examine the vegetation only along the solitary forest road, or on a path where an elephant has trodden before, or along a water course, if you like to walk for half a day in water up to your knees. A very few small bare patches exempted, the whole plateau forms one huge evergreen forest. The trees stand dense, have generally a rounded head, and rise to an enormous height. It is, therefore, very difficult to get at their flowers and fruits. In most cases it is impossible to climb the trees. Ropes and hooked knives on long sticks are useful under ordinary circumstances, but up there they could rarely be used. In many cases the gun was the only instrument to get leaves and flowers down. The stems are usually straight and so close together that huge trees, whose lower parts have decayed, are kept in position by their neighbours. The upper part of the stem and the branches are covered with epiphytic vegetation, usually ferns, orchids, species of *Piper*, and especially of *Kendrickia walkeri*, one of the most beautiful plants India has produced, not to mention a great profusion of the most varied mosses and lichens and parasitic species of *Loranthus* and *Viscum*. The undergrowth of the forest is dense and high, and perfectly impenetrable, unless you constantly use your hatchet. It is, however, no pleasure cutting down siliceous bamboos and spinous

Calami, when you have to disentangle yourself after every stroke. The elephants have done pioneer work in that direction. We are only sorry that we never met one of that tribe in order to express to him our deep-felt gratitude. We must, indeed, be grateful to them; but for them our harvest would have been a poor one. We are strongly in favour of a law protecting that most scientific of Indian animals.

There is scarcely any herbaceous vegetation under the trees. The evergreen forest can at once be distinguished from the deciduous one by the almost total absence of grasses. It was only on bare rocky spots or along the water courses that we found a varied herbaceous flora. Several species of *Impatiens* and *Begonia, Utricularia, Klugia notoniana, Viola, Thalictrum Javanicum, Polygala, Drosera, Burmannia, Lobelia, Kalanchoe, etc.,* were found in those localities.

The ferns deserve a special note, and I have to thank Mr. Almeida for it. A few hundred feet from the foot of the mountain we meet those ferns which are able to withstand the heat of the sun and long periods of drought. *Adiantum caudatum* first makes its appearance. Higher up the beautiful little *Actinopteris,* which is likewise an inhabitant of dry rocky places, attracts our attention, and from the crevices in the rocks project the heart-shaped fronds of *Hemionitis.* The hardy *Schizoloma ensifolia* and the bracken fern (*Pteris aquilina*) occur higher up at about 3,000 feet elevation. But the favourite habitat of the ferns is the evergreen forest, where shade, shelter, and abundance of moisture have given rise to their most luxuriant development. There in the twilight of the forest, the *Asplenieæ* vie with each other in the delicacy of their foliage. Of the *Aspidieæ* the most interesting plant is *Oleandra musæfolia* whose stem, resembling a serpent, hangs down from the rocky ledge. The most favourite spots, however, are the mossy banks of the brooks. It is here that we find the gigantic tree-ferns. One of these, *Cyathea spinulosa,* acquires in some places a height of 15-20 feet.

So far the general aspect of the vegetation. As to the exact composition of the flora we shall be able to give accurate data after having worked out the material. In the meantime it may suffice to indicate the chief distinctive characters of the flora of the High Wavy Mountain, when contrasted with the vegetation of the Deccan. It is firstly the presence of a great number of *Guttiferæ, Dipterocarpaceæ, Myristicaceæ, Palmæ,* and *Bambuseæ,* secondly, the great excess of species of Malayan type, especially *Sterculiaceæ, Anacardiaceæ, Meliaceæ, Ampelidaceæ, Gesneraceæ, Piperaceæ* and *Orchidaceæ.* We have examined only a small part of about 2,000 specimens brought home. The result seems to be satisfactory. Of Orchids we have described 6 new species and several varieties, of Vines about 5 species. Other orders, too, seem to promise well. It is not astonishing in the least that there should be many new species. If we consider that Fyson has discovered 13 new species on the Nilgiri and Palni Hills (above 6,500 feet) which had been explored repeatedly by many botanists in the course of 150 years, it is only natural that unknown forms should be found in a somewhat isolated area, which has never been visited, not even by a collector. There are many similar spots in India and of a much wider area, which are practically unknown from a botanical point of view.



The Late Fr. DRECKMANN, S.J.

OBITUARY NOTICE.

It is our painful duty to record in this Journal the death of two of our members, *viz.*, the Rev. Father F. Dreckmann, S.J., and Lt.-Col. K. R. Kirtikar, I.M.S. (Retd.)

REV. FATHER F. DRECKMANN, S.J.

Fr. Dreckmann was born at Soest in Westphalia on the 11th August 1840 and joined the Society of Jesus at the age of nineteen. After going through the usual comprehensive course of philosophical, scientific and theological studies, he was sent to India. It is interesting to note that he was posted to this country by a mere accident. It was arranged that he was to go to Ecuador as Professor of Physics, and he had already begun to study Spanish when an inquiry came from his superiors if he would proceed to India. He willingly consented. Six weeks were all that was allowed to him to learn the language in England, and at the end of that period he sailed for India and arrived in Bombay on the 13th November 1874.

He was posted to St. Xavier's College. Being appointed to superintend the boarding establishment for a few months, he was soon made Professor of Physics. A former student of his writes of this period: "Being of a scientific turn of mind and having a natural predelection for scientific pursuits, Fr. Dreckmann had devoted considerable attention in his student days to the study of science and thoroughly mastered its principles. Mathematics and Physics were his speciality. Having a clear intellect and a powerful memory, though hampered by a weak husky voice, he soon succeeded in arresting attention and gained the confidence of his students. Talking of his memory, I am reminded of his habit of working out the most difficult problems in Trogonometry and Physics from memory alone, without touching the black-board, and inculcating the same habit upon us. Whether it was a problem in Heat or Sound, or a complicated example in the co-efficient of friction, the same method was followed, and when, at the end, the question was put to us, as was his wont, 'Is it clear?', and the whole class with one voice answered: 'No, Father, it is not!' it was a study to watch his face, simple, innocent, guileless, wondering for the nonce how a set of rational beings could really be incapable of understanding 'such a simple thing.'"

In 1884, Fr. Dreckmann was made Principal of St. Xavier's College. In 1882 already he had been elected a Fellow of the Bombay University and was a member of the Syndicate for over 20 years. That his work in the educational line was appreciated we may judge from a few remarks made by the Director of Public Instruction in his official report for 1902-07: "The Principal, Fr. Dreckmann, is one of the oldest members of the University, and one of its wisest and most trusted advisers."

But there were other spheres of his activity in which he was equally useful. He was a zealous and enthusiastic student of Natural History and a prominent member of our Society almost from its very beginning. He contributed some interesting notes to the earlier volumes of our Journal and the very first plate published by the Society belongs to an article on "An Undescribed Hamalopsida" from the pen of Fr. Dreckmann. He was a member of the Managing Committee, acted as one of the Vice-Presidents for a number of years, and was President of the Reptile and Fish Section.

From early youth he took a delight in watching reptiles and birds and later in life he made a special study of the snakes of the Bombay Presidency. During his holidays, which he always spent at Khandala, he would wander about in the wild romantic ravine that stretches out between the "Reversing Station" and the "Duke's Nose," and study its fauna and flora. Bloodsuckers, scorpions, spiders, jungle cats, snakes and other interesting denizens of the wilds of nature were the most favourite objects of his observations. He knew how to catch alive the most deadly snakes, with an almost uncanny calmness, and would watch their habits in captivity. A considerable part of the biological collections of St. Xavier's College consists of reptiles which he had caught and prepared himself. Fr. Dreckmann was not a writer and very little has been published under his name; but many a scientific article written by others. has been enriched by his valuable accurate observations.

In 1910, Fr. Dreckmann retired from the post of Principal which he had occupied for a full quarter of a century. He would have no farewell meeting or ceremonies of any kind. He disappeared from Bombay and took refuge in his favourite place, Khandala. But the loneliness of St. Xavier's Sanatorium, and the piercing winds that blew there from the Deccan during the cold season, were too much for him, and by the middle of February 1911 he returned to the College. There he spent some quiet years, till about 18 months before his death the sufferings of old age confined him to his room. This was a severe trial for one of so great natural energy and interest.

Fr. Dreckmann died on the 7th June of this year. We have lost in him a man of deep conviction, transparent sincerity, and unflinching courage in expressing his opinion. He would stand no nonsense, there was no humbugging with him, he hated cant and hypocrisy, he liked to deal with men who were sincere and upright and anything savouring of underhand dealing was detestable to him. All who have met him will remember his robust figure, his deep-set piercing blue eyes, his bluff manner, and at times his scowling looks, but they will, at the same time, never forget, that under the grim exterior there beat the kindliest of hearts.

E. B.

Lieut.-Col. K. R. KIRTIKAR, I.M.S. (Retd.)

Lieut.-Col. Kirtikar was born in Bombay on 24th May 1849. After the usual College education he joined the Grant Medical College in 1871. Three years later he left for England to compete for the Indian Medical Service. He returned to India in 1877 and was placed on general duty in Bombay. When the Afghan war broke out he was on field service from 1878 to 1880. For his gallant behaviour at the battle of Maiwand, Surgeon Kirtikar was appointed Civil Surgeon of Thana in 1881. The following years saw him in a great variety of offices. He was Fellow of the Bombay University, Syndic in Medicine, Professor of Anatomy, Botany, and Materia Medica at the Grant Medical College, and held in addition a number of medical appointments. In 1902 he became Brigade Surgeon-Lieut.-Col. In 1904 he retired after completing the 55th year of his age and 27 years of useful and distinguished service.

The interests of Lieut.-Col. Kirtikar were many and varied, social, literary and scientific. There is specially one subject for which he has shown not only a keen interest but also a marked talent throughout his whole career, *viz.*, Botany. It was shortly after his retirement from public service that I paid him a visit at Andheri, which he had chosen as a residence for the rest of his life. I found him amidst his books, chiefly botanic, and he delighted in showing me his valuable volumes, his microscopes, his collections of dried plants, his water-colours of Algæ and Fungi, and many other things that interest only an enthusiast. All this was the result of his spare hours (for he had been a busy man) ; he had kept his eyes open, he had read a good deal, he had seen much in many lands, he had taken notes on many botanical subjects and jotted them down in books and on slips of paper that were scattered all over the library. There is no department in Botany, except perhaps physiology, which he did not cultivate. To him personally this way of studying must have been a source of constant pleasure, and we do not blame him for having followed his own likings. But if we consider, what a talent like his could have achieved in the advancement of botanical science in India, we can scarcely suppress a feeling of regret at the thought, that there was not more method and more concentration in his way of working. These remarks, however, must not close our eyes to the real value of the work he has done. The many contributions to our journal were written at a time when professional duties claimed all his energy, and it is astonishing that he has been able to do so much. A posthumous work of his on the "Medicinal Plants of India" will soon see the light, as he entrusted its publication to his friend Major B. D. Basu, I. M. S.

I need not describe his character. Those who had the pleasure of meeting him know only too well that by his death on 9th May a real gentleman and a faithful friend has passed from our midst.

E. B.

MISCELLANEOUS NOTES.

No. I.—THE BREEDING OF THE WHITE-EARED BULBUL (*MOLPASTES LEUCOTIS*).

In the Fauna (Volume I, page 274) the breeding season of this species is given as "from May to August" and the number of eggs laid as "three or four."

In Hume's "Nests and Eggs" (page 177 of Volume I, 2nd Edition) it is noted that it breeds "for the most part in July and August in the Punjab, but somewhat earlier in Sindh. I have, even in Rajputana, seen eggs towards the end of May, but this is the exception."

It may therefore be worth noting that the breeding season in this district, where the bird is common, begins towards the end of March, and that frequently not more than 2 eggs are laid.

I give below particulars of nests found this year:—

March 26th. A nest containing 3 eggs, slightly incubated.
" 27th " " 1 egg, nest deserted.
" 28th " " 2 eggs, hard set.
" " " " 2 " slightly incubated.
" " " " 3 " on the point of hatching.
" " " " 2 " incubation just begun.
" " " " 3 " fresh.
" 31st " " 3 " incubated.
" " " " 2 half-fledged young.

1 of these nests was in a small Jhand tree (*Prosopis spicigera*), 1 in a Kari bush (*Capparis aphylla*), 5 in Ber bushes (*Zizyphus jujuba*), and 2 in *Sarkanda* grass.

H. W. WAITE,
Indian Police.

FEROZPORE, PUNJAB, 1*st April* 1917.

[In the British Museum there are two clutches from Jask taken by Mr. S. Butcher on 23rd and 29th March respectively—EDS.]

No. II.—THE INDIAN GRACKLE OR "HILL MYNAH" (*GRACULUS INTERMEDIUS*) RESIDENT IN CALCUTTA.

I send you the following information as it may interest some of your readers. Last month while spending a week end at the Botanical Gardens, Sibpur, I was walking round the Gardens with the Curator and on approaching some fine tall trees I was greeted by a familiar sound which I did not expect to find down here. On peering about I spotted a fair number of Hill Mynahs in among the topmost branches of the Casuarina and Mahogany trees. On pointing the birds out to my friend, he told me that Lady Prain some 14 years ago let 4 pairs of *Graculus intermedius* loose in the gardens and that ever since they had stayed and bred here. I think this fact of the Hill Mynah having gone back to his wild state and doing well in a climate like Calcutta is interesting.

A. E. LOWRIE, CAPT., I.A.R.O.

CONTINENTAL HOTEL, CALCUTTA,
12*th June* 1917.

[Though called the "Hill" Mynah this bird is not confined to the hills. It is found in the Himalayas, Assam and Burma to Malay Peninsula, and in the Nepal Terai, where it breeds and Ball recorded it from Gangpur, Jaipur, Bustar, &c. A race is found in the Andamans.—EDS.]

No. III.—NOTE ON THE GREAT BROWN VULTURE (*VULTUR MONACHUS*) IN CAPTIVITY.

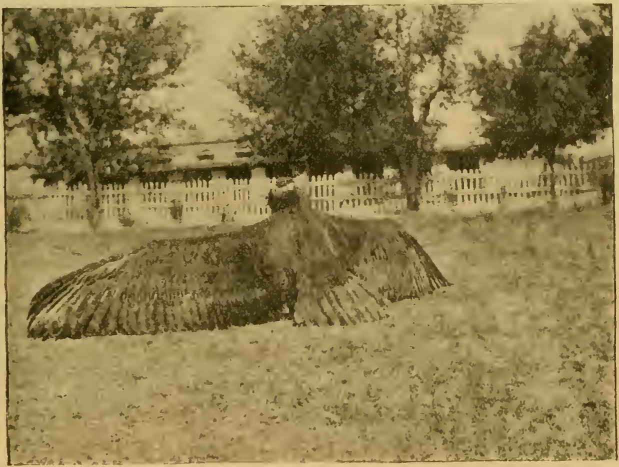
Last May (1915) this young bird was brought in by a Wazir, who stated that he had taken it out of a nest in the Marwattai mountains, N. W. of the Wano Plain, after shooting the parent bird. He said that the nest was at the top of a large fir tree. The previous year when I was up in the Mar-wattais in about the same place as this nest is said to have been found, I saw a nest of a large vulture containing one young bird, and watched it from the top of a cliff with my glasses. I think it was very probably the same nest.

When this young bird was brought in to me it cannot have been more than a few days old, and it was then covered with brownish-grey down. The cere was light pink and bill darkish at tip, irides yellowish, legs and feet creamy white, and claws black. I fed it on raw meat and it grew very fast. Photo 1 shews it as it was at about a month old. It had then begun to grow long dark brown feathers on its back, body and wings, and also the ruff at the back of its neck. At this time it was not strong enough to stand up. At first it would only feed from my hand and would open its mouth like any other young bird to have the food dropped into it, but after two or three days it took to feeding itself from a plate. I kept it in a stable and after some days I noticed that the walls all round up to about 18 inches from the ground were covered with its excreta. I could not understand this until one day I noticed it shuffle backwards till it reached the wall, when it lowered its head, raised its tail and squirted its excreta up on to the wall. Apparently it always went through this performance when it wished to relieve nature. The only reason that I can think of for this is that while in the nest it was probably in the habit of getting to the edge and relieving nature over the side, and it was trying to do the same still. It did not

No. 1.

No. 2.

show any inclination to fly for a long time and when it did seem to wish to, it did not know how to. It would spread and flap its wings and jump up into the air, but never got any distance off the ground until it was about 5 months old, when it gradually took to taking short flights. It is now a



No. 3

year old and can fly quite well, but it never leaves the Fort. It is quite tame but does not care about being handled, although it will submit to having the back of its head rubbed. The last photo shews the bird in its full plumage. It is now beginning to mult.

The description of the adult bird as given in Jerdon is correct, except that the cere of my bird is almost salmon-pink, and the naked part of the neck is dirty white with a very slight tinge of red. The leggs are creamy-white and not dusky-yellow.

I have never seen another specimen of this vulture round Wano, though the Common Brown Vulture and Bearded Vulture are common. I have occasionally seen a pair of them on the banks of the Indus near Dera Ismail Khan, and also near Murtaza at the foot of the hills.

[The above was written by the late Major F. L. Hughes, 20th Brownlow's Punjabis (South Waziristan Militia) about May 1916.

The vulture eventually disappeared in February 1917, having been in Wano Fort for nearly 2 years. Major Hughes presumed that it flew away of its own accord.]

No. IV.—OCCURRENCE OF THE ASHY WOOD-PIGEON (*ALSOCOMUS PULCHRICOLLIS*) IN THE JALPAIGURI DISTRICT.

While spending a holiday in the Duars with my friend Mr. E. O. Shebbeare of the Forest Service, he told me that he had procured this bird at Gorumara on 1st May 1909. I failed to get the bird there myself and so was very pleased when he sent me a skin of this bird a short time ago which had also been got at Gorumara by Mr. W. P. Field and sent to him for identification. Mr. Field has shot this bird before also at Gorumara during the cold weather, I understand, his second specimen being got in March or April I believe.

Gorumara is about 13 miles as the crow flies from the foot of the hills, the bungalow being situated in the forest. The general level of the country where the bird is got is about 300 ft. above mean sea level and so is very much lower than any of the elevations given by Mr. Stuart Baker in his "Indian Pigeons and Doves." Mr. Baker writes "this Pigeon is found in Nepal, Sikhim, and Tibet at elevations between 7,000 and 10,000 feet, possibly descending a good deal lower than this in winter." The lowest elevation mentioned by him is 4,000 feet. It will be seen from those Duars specimens that this bird is got at a very low elevation in *summer* and not only in *winter* as presumed by Mr. Stuart Baker. It would appear that this bird is a permanent resident at any rate in that part of the Duars. From what Mr. Shebbeare writes, I understand they are fairly common round about Gorumara. There is no mistake in the identification as I know the bird well having shot it near Darjiling. Through the kindness of Mr. Shebbeare, I have been able to send this interesting note.

CHAS. M. INGLIS.

BAGHOWNIE FTY., LAHERIA SARAI,
4th June 1917.

No. V.—THE BREEDING OF THE GULL-BILLED TERN (*STERNA ANGLICA*).

As the information on record regarding the breeding of the Gull-billed Tern within Indian limits appears to be confined to Hume's account of his find of a single egg on the Chenab on the 28th April 1870, the following note may be of interest:

I found this species breeding on a sand-bank in the Beas, near the junction with the Sutlej, on the 16th April last. Other species nesting on the same bank were the Indian River Tern (*Sterna seena*), The Indian Skimmer (*Rhynchops albicollis*) and the small Indian Pratincole (*Glareola lactea*).

I counted 9 nests in all of *Sterna anglica*, but there may have been one or two more which were not noticed. They were all more or less grouped with those of *Sterna seena*, on the middle, and highest, portion of the bank, where there were occasional small tufts of grass. In each case the nest consisted of a slight depression in a tiny mound of sand, which in one or two instances appeared to have been scooped up by the birds. Every nest contained one or two small pieces of stick or other debris for the eggs to rest on, except that in one case a little dry grass had been provided instead. This fact alone would have served to distinguish the nests from those of *Sterna seena*, which were invariably *bare* depressions in the sand. one of the nest contained 1 egg only, while of the rest, three contained 3, and five 2. All the eggs which I took were perfectly fresh. I shot one bird, a male, to make certain of identification. The birds of this species did not appear to be on particularly good terms with their neighbours, and I noticed them "having words with" *Sterna seena* and *Rhynchops albicollis* on more than one occasion. The two latter species, however, never seemed to quarrel. Their nests were freely intermingled, although *Rhynchops albicollis* appeared to have a preference for absolutely bare sand without a trace of vegetation.

The nests of *Sterna seena* were by far the most numerous. None contained more than 3 eggs, and every egg which I took was perfectly fresh. The same was the case with *Rhynchops albicollis.*

Of all the denizens of the bank, *Sterna seena* resented my intrusion least, whilst *Glareola lactea* was the most perturbed. This was probably due to the fact that the eggs of the latter species were mostly in various stages of incubation. All their nests were grouped together on one side of the bank, not far from the water's edge. I found 3 eggs in one nest, but this was the only case in which there were more than two.

A solitary pair of Black-bellied Terns (*Sterna melanogaster*) were noticed flying over the bank, and their nest was afterwards discovered on the mainland, some 15 or 20 yards from the water's edge, lower down the river. It contained two slightly incubated eggs.

This was the only nest found of this species. There were a few nests of *Glareola lactea* in the vicinity, none of which contained more than one egg.

H. W. WAITE,
Indian Police.

FEROZEPORE, PUNJAB,
3rd July 1917.

No. VI.—LATE STAY OF TEAL (*NETTIUM CRECCA*).

On the evenings of the 27th and 30th April and 2nd May of this year about 6-30 P.M. I have seen three large flocks of teal flying north. Is this not very late in the year?

I was standing in the same place on each evening and on each occasion the flocks flew straight over my head.

I should be interested to hear whether it is usual for teal to stay so late. There were uncommonly scarce in these parts this year during the shooting season.

E. J. D. COLVIN, CAPT.

AGAR, MALWA, C. I.,
3rd May 1917.

No. VII.—THE HEIGHT AT WHICH BIRDS ARE ABLE TO FLY.

On page 606, No. 3, Vol. XXIV of our Journal, Mr. Hankin asks for information on the above point, so the following may be of interest to him. A few years ago I was stalking a herd of Bhurrel (*Ovis nahura*). The herd was browsing on the hill side about 1,000 feet above me and a sentry was on the look out, motionless, on a projecting ledge, so it behoved me to be particularly careful. I had been for sometime reclining against a rock, screened from those all seeing eyes by a juniper hedge, and biding my time until they should move on for their midday quarters. I had been amusing myself watching a flock of choughs circling over a peak straight above the sheep, with a powerful pair of Zeiss glasses (12 magnification), when into my vision there came, what I, at first, took for a white feather floating across the sky. This was followed by another and still another and interested me not a little. I then steadied my glasses against my knees, and my head against the boulder and looked more carefully. I then thought they must be white pigeons, but could not understand what pigeons could be doing at such heights. When they came directly over me, I was able to see that they were not pigeons, as I could just make out the slow deliberate beat of the wing of some very big bird. There were five altogether and they came from the direction of the plains and were passing over in a north-easterly direction.

I could see no marking of any sort on them and they all appeared to me to be pure white. The flight was that of a stork or crane.

A few slow deliberate flaps, and then a bout of sailing on still pinions, the former indulged in at very long intervals. The birds were obviously migrating though rather late in the year (end of May), and assuming they were storks or Siberian Cranes, *i.e.*, birds about 10 feet or so from tip to tip, at what height must they have been flying above me, to appear the size of pigeons through a powerful glass, on an absolutely clear morning, in such clear atmosphere?

I was at the time at between 14,000 and 15,000 feet above sea level. They crossed the range of mountains into Spiti.

In conclusion I may add that the Lammergeyer (*Gypaëtus barbatus*), the Himalayan Griffon (*Gyps himalayensis*) and Choughs (yellow-billed) (*Pyrrhocorax alpinus*) may often be seen at 16 to 18,000 feet.

DHARMSALA, 10*th April* 1917. C. H. DONALD, F.Z.S.

[Various observers have regarded the heights at which birds have been seen In 1880 W. E. D. Scott published a note on two birds he observed through an astronomical telescope at Prince town, U. S. A. He calculated the height the birds were flying at as being about half a mile and he thought he could recognise the species. Later F M. Chapman—in the "Ank" we believe—recorded some similar observations in which he gave the height to be from 600 ft. to 1,000 ft. and from 3,000 ft. to 15,000 ft. Others have written their observations taken under similar conditions but only 5,400 ft. appears to be the limit of altitude at which they have observed birds in flight.—EDS.]

No. VIII.—THE SPAN OF LARGE BIRDS.

On page 606 of No. 3 of Vol. XXIV of the Bombay Natural History Society's Journal, Mr. Hankin asks the above question. He mentions having heard of an Adjutant, presumably *Leptoptilus dubius* which was shot in India, as being 18 feet approximately. Surely this must be wrong? I have never measured an Adjutant but considering Blanford gives the length of wing (*i e.*, from the bend of the elbow to the tip of the longest primary) as only 32″ it is hard to understand how one can possibly be 18 feet across.

In the case of most of the large birds of prey, if you take the span as between 3 and 4 times the length of the wing, you will not be far wrong. For instance :—

A. chrysaëtus—Wing say 25″, span 80 to 88 inches.
A. heliaca—Wing say 24½″, span 82″ (a specimen carefully measured by me lately).
Gypaëtus barbatus—Wing say 32″, span 9 to 9½ feet.

This being the case it is hardly conceivable that any bird with a 32″ wing can possibly have a span of anything approaching 18 feet.

It is true that an Adjutant is a bigger bird than either of the above mentioned, and when seen soaring in company with Vultures, he certainly looks bigger, but I should not think that there is much more than a couple of feet, at most, between them. The Cinereous Vulture (*V. monachus*) and the Himalayan Griffon (*Gyps himalayensis*) with a wing measurement of 30″ in each case would probably have a spread of 10 feet or so, as they *appear*, if anything, a trifle larger than the Lammergeyer on the wing, but as I have never measured them I cannot speak with any degree of certainty.

Differences in size in the same species are of course, possible, but the actual amount would not count for much, except in the case of a male and female in which case there might be as much as a foot between a large female and a small male, of the same species.

Any authenticated figures on the subject would be most interesting and I trust before long, some of our Members will oblige with their experiences.

DHARMSALA, 10*th April* 1917. C. H. DONALD, F.Z.S.

No. IX.—NOTES ON THE BIRD LIFE OF AHWAZ, PERSIA.

The following notes have been collected in the intervals of military duty whilst stationed at Ahwaz. I forward them for what they are worth :—

The Raven (*Corvus corax*).—Several pairs observed during January, February and March after which they disappeared, probably to breed.

The Grey-backed Warbler (*Aëdon familiaris*).—Breeds at the beginning of May. Constructs a rather obvious nest of sticks in a low bush, lining the nest with the small cottony capitulated heads of a composite plant. Eggs 4 in number almost identical in colouration with those of the King Crow of India. Spreads its brown chestnut tail at intervals like the Fantailed Flycatcher.

The Olivaceous Tree-Warbler (*Hypolais pallida*).—Fairly common.

Streaked Wren-Warbler (*Prinia lepida*).—Breeds in small tamarisk bushes along the banks of the Karun in May and June.

Lesser Grey Shrike (*Lanius minor*).—Shot a specimen in April 1917.

Pale-brown Shrike (*Lanius isabellinus*).—Shot a specimen in April 1917.

Caucasus Starling (*Sturnus vulgaris caucasicus*).—Abundant during winter.

The Wheatear Chat (*Saxicola œnanthe*).—Shot a specimen in April 1917.

House Sparrow (*Passer domesticus*).—Exceedingly common.

The Ortolan Bunting (*Emberiza hortulana*).—Shot a specimen in April 1917.

Swallow (*Hirundo rustica*).—Common. Breeds in April.

Sand Martin (*Cotile riparia*).—Fairly common.

Large Crested Lark (*Galerita cristata magna*).—Common. Breeds in May.

Egyptian Nightjar (*Caprimulgus ægyptius*).—I found these birds paired in May but could not find their eggs.

Pale Brown Swift (*Cypselus murinus*).—Common. Probably breeds here.

European Roller (*Coracias garrula*).—Common. Breeds in holes in the banks of the Karun about middle of May.

Blue-cheeked Bee-eater (*Merops persicus*).—Arrives in March and breeds in May in the banks of the Karun and in trenches around Ahwaz.

European Bee-eater (*Merops apiaster*).—Breeds in May and June in similar situations to *M. persicus.*

Pied Kingfisher (*Ceryle rudis*).—Only a few pairs seen in the vicinity of Ahwaz.

White-breasted Kingfisher (*Halcyon smyrnensis*).—Rare around Ahwaz.

European Hoopoe (*Upupa epops*).—Fairly common during March and April.

Black Kite (*Milvus migrans*).—Common around Ahwaz in the winter and early spring. Disappears as soon as the hot weather sets in.

Pale Harrier (*Circus macrurus*).—Seen only in January, February and March.

Egyptian Vulture (*Neophron percnopterus*).—Common. Breeds in March and April.

Griffon Vulture (*Gyps fulvus*).—Common in spring of 1917.

Turtle Dove (*Turtur communis*).—Appears in the corn fields when the crops are ripe. Disappears with the advent of the hot weather.

Large pin-tailed Sand-grouse (*Pteroclurus alchata*).—Occurs around Ahwaz and throughout desert tracks on both banks of the Karun in almost inconceivable numbers. In the winter they keep for the most part in flocks of enormous size. I never struck a drinking pool. They pair in April and lay at the end of May and beginning of June. Clutches vary from 2-3, more often the latter. No attempt at any nest, just a mere depression in the ground serves their purpose. There seems to be a good deal of local migration. Towards the latter half of April I observed such an event at Ahwaz. For almost a week hundreds of thousands of these birds could be seen in the cool of the morning and evening flying almost due south. How this bird manages to brood over her eggs on the bare ground, sweft at this time of the year by violent sand storms, and in the appalling heat of these parts passes my comprehension. There is great variation in the size and colour of the eggs.

Spotted Sand Grouse (*Pteroclurus senegallus*).—Occurs around Ahwaz, but is comparatively rare compared with P. alchata. Breeds there but I never secured a clutch.

Black Partridge (*Francolinus vulgaris*).—Occur wherever there is favourable jungle.

Seesee (*Ammoperdix bonhami*).—Occasionally seen during the winter in the small hills near Ahwaz.

Common Quail (*Coturnis communis*).—Saw a few during the early spring.

Common Crane (*Grus communis*).—Occurs and has been shot around Band-i-Qir.

Little Bustard (*Otis tetrax*).—Major Watts reports this bird from the neighbourhood of Shush.

Great Bustard (*Otis tarda*).—Major Watts reports a flock of about 6 of these birds on the Amarah-Shush road about one day's march beyond Amarah. They were very wild and would let no one approach within 400 yards without taking wing.

Houbara (*Houbara macqueeni*).—Occurs around Ahwaz.

Stone Curlew (*Œdicnemus scolopax*).—Fairly common around Ahwaz where it breeds in April and May.

Cream-coloured Courser (*Cursorius gallicus*).—Occurs sparingly around Ahwaz where it probably breeds.

Collared Pratincole (*Glareola pratincola*).—Exceedingly common around Ahwaz in the spring and summer. Breeds in April and May. I found a colony of about 15 pairs of these birds breeding on an island in mid stream just below the Ahwaz rapids. Clutches varied from 2-3. Nest a mere hollow in the sand generally under the shade of the Camel Thorn bush (*Alhagi manorum*).

Red-wattled Lapwing (*Sarcogrammus indicus*).—Fairly common. Breeds in April and May.

Lapwing or Peewit (*Vanellus vulgaris*).—Found sparingly in the winter months. Disappears in March.

White-tailed Lapwing (*Chettusia leucura*).—Common after rain.

Caspian Sand-Plover (*Ægialitis asiatica*).—Arrives in March and is found in flocks on the open plains. Disappears in April.

Kentish Plover (*Ægialitis alexandrina*).—Very common. Breeds in April and May. Clutch normally three, sometimes two.

Black-winged Stilt (*Himantopus candidus*) —Common after rain.

Avocet (*Recurvirostris avocetta*).—Common in winter after rain.

Black-tailed Godwit (*Limosa belgica*).—Common after rain.

Spotted Redshank (*Totanus fuscus*).—Shot two near Ahwaz in March 1917.

Ruff (*Pavoncella pugnax*).—Shot a specimen at Ahwaz on 29th March 1917. Saw a few others.

Dunlin (*Tringa alpina*).—Shot a specimen on 18th March 1917.

Common Snipe (*Gallinago cœlestis*).—Common.

Woodcock (*Scolopax rusticola*).—Recorded from Shush by Major Watts.

Laughing Gull (*Larus ridibundus*).—Common around Ahwaz in the spring.

White-winged Black Tern (*Hydrocheledon leucoptera*).—Saw a pair flying up the Karun, 13th May 1917.

Common Tern (*Sterna fluviatilis*).—Saw 2 or 3 pairs around Ahwaz in May, where it probably breeds.

Little Tern (*Sterna minuta*) Black-shafted Ternlet (*Sterna saundersi*).—Either one or the other, or possibly both of these species are found sparingly on the Karun around Ahwaz, where they breed on the islands. I did not shoot any specimens.

Common Cormorant (*Phalacrocorax carbo*).—Saw a few small flocks of these birds in the winter.

White Stork (*Ciconia alba*).—Common at Ahwaz in February and March after rain.

Common Heron (*Ardea cinerea*).—Found sparingly on the Karun near Ahwaz in winter and spring.

Bittern (*Botaurus stellaris*).—Shot a single specimen at Ahwaz in February 1917.

Grey Lag Goose (*Anser ferus*).—Found occasionally around Ahwaz in the winter.

Sheldrake (*Tadorna cornuta*).—Saw a pair at Ahwaz in February 1917.

Mallard (*Anas boscas*).—Common.

Gadwall (*Chaulelasmus streperus*).—Shot a ♂ in February 1917. Common at Shush.

Common Teal (*Nettium crecca*).—Common.

Pintail (*Dafila acuta*).—Common.

Shoveller (*Spatula clypeata*).—Common.

Marbled Duck (*Marmaronetta angustirostris*).—Major Watts records this bird as breeding at Shush in May 1916. This is interesting. I have already secured eggs of this species at Sonmeani on the Baluchistan coast. Mr. Aitken also records it breeding on the Khushdil Khan Lake, Quetta.

It is almost certain also that it breeds sparingly in Sind. I quote the following from my note-book, 28th December 1915:—

"Have just returned from the Manchar Lake, Sind. The Mohannas tell me that the Marbled Duck breeds on the lake in fair numbers in favourable years. I have no reason for doubting this information as it was volunteered, and moreover these Mohannas know the Sindhi and English names of every duck to be found there. It seems to me that the Marbled Duck must now be regarded as a regular breeder in Sind and Baluchistan.

Pochard or Dun-bird (*Nyroca ferina*).—Shot a ♂ in February 1917.

MESOPOTAMIA EXPEDITIONARY FORCE, F. LUDLOW, I.A.R.O.
May 1917.

No. X.—THE WEIGHTS OF PINTAIL AND FANTAIL SNIPE.

Since writing to you on 18th January 1915 on the subject of the comparative weights of Pintail and Fantail Snipe, I have now compiled the figures for the past three seasons in this neighbourhood, and submit them, as I think they may be of some interest. I shall be glad to hear if others have carried out similar experiments, and to compare their results with mine.

SEASON : *September* 1914—*March* 1915.

The average weight of 375 Pintails was 3·90 oz. while that of 151 Fantails was 3·25 oz.

SEASON : *October* 1915—*April* 1916.

The average weight of 998 Pintails was 3·81 oz. while that of 84 Fantail was 3·51 oz.

SEASON : *September* 1916—*March* 1917.

The average weight of 974 Pintails was 4·07 oz. while that of 63 Fantails was 3·48 oz.

Very occasionally a big Fantail would be found, and I have a note of one weighing 5½ oz., shot on 20th February 1916 and one of 5 oz. shot on 11th March 1917.

The above appears to be conclusive that in Southern India at any rate the Fantail Snipe is decidedly the lighter bird.

Jack Snipe have weighed from 1⅝ to 2 oz.

The past season has been somewhat remarkable for the fact that not a single specimen of Jack Snipe was seen, either by my shikari or myself, though I know of two having been shot by another sportsman. My previous experience has been that they make about 1 per cent. of the bag.

MADURA, S. INDIA, R. F. STONEY.
24th June 1917.

No. XI.—THE BRONZE-BACKED TREE SNAKE (*DENDROLAPHIS TRISTIS*) IN CENTRAL INDIA.

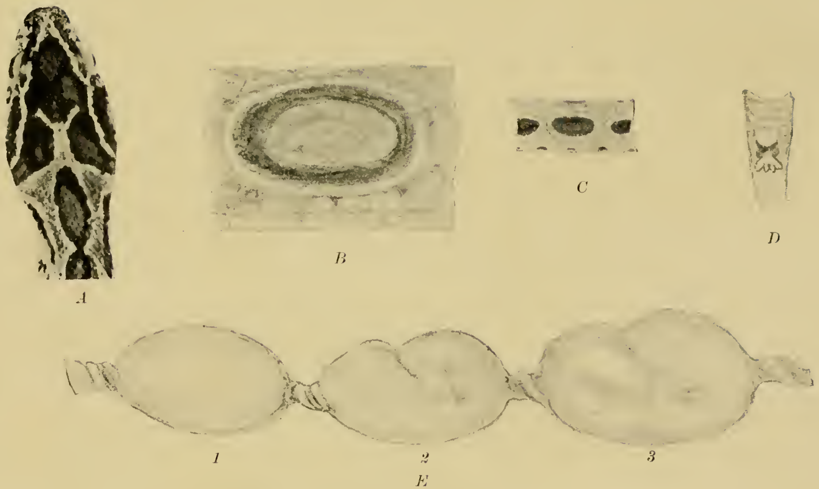
I send a snake. Is it not *Dendrolaphis tristis*? If so, Wall says:—Journal Vol. XIX, p. 786—"It has not been recorded from Central India. They are by no means uncommon in the teak forest here and are called by the Bhils "Urni Saup," *i.e.*, the flying snake. It is believed, as usual, to be deadly.

THE AGENCY, MANPUR, C.I., C. E. LUARD, MAJOR.
4th May 1917.

[The snake sent by Major Luard proved to be *Dendrolaphis tristis*. —EDS.]

No. XII.—THE BRONZE-BACKED TREE SNAKE (*DENDROLAPHIS TRISTIS*) IN THE CENTRAL PROVINCES.

In Vol. XX, p. 857, Mr. Bernard Cooke records the occurrence of this snake at Dhaura, which is about two miles beyond the boundary of these Provinces, and the other day I secured one at Nagpur; it being the first I have seen during the last six years. The great gap in its distribution in Central



THE RUSSELL'S VIPER (*VIPERA RUSSELLI*).

EXPLANATION OF FIGURES.

A. The characteristic markings on the head of a newly born viper.
B. The dark ring edged with white, surrounding an oval chocolate brown area (adult).
C. The undifferentiated oval spot edged with white (new-born viper).
D. Sacs or cœca near the vent.
E. Three eggs connected by a strand formed by egg-membrane : 1 The most anterior least developed ; 2 and 3 more advanced.

India is thus bridged over by these records, and it now remains to find out how far it extends northward into the United Provinces. There were no specimens of it in the Lucknow Museum, when I examined the snakes there in December 1908.

My specimen, which is deposited in the Nagpur Museum, is a typical one, except that the scale rows reduce to 13 at about 3 inches before the middle of the body. The ventrals are 193 and the sub-caudals in 126 pairs.

E. A. D'ABREU, F.Z.S.

CENTRAL MUSEUM, NAGPUR, C. P.,
8th June 1917.

No. XIII.—NOTES ON THE RUSSELL'S VIPER.

(*With a Plate.*)

The following notes relate to the young ones which a Russell's viper produced in the Central College Museum. An adult female specimen, measuring about 4 feet, was obtained locally towards the first week of December 1916, and on the 8th June 1917, the young ones were born. Assuming that fertilisation took place in November,—there is no other evidence for this assumption than the testimony of the snake charmers who are unreliable in such matters—the period of gestation has occupied in this case roughly seven months.[1] Of the six young daboiæ that were produced, three were still-born, and in addition three eggs were deposited. Except in one egg, no trace of development could be made out in others and it is doubtful whether these latter were impregnated at all.[2] The eggs are translucent, reddish and are soft; the leathery shell of the eggs belonging to the Elapinæ group is replaced by a soft membrane. They are held together by a gelatinous twisted cord which may be of immense length sometimes and which hardens on exposure. Each egg measures 30 mm. along the longer axis.

The young ones moult soon after rupturing the vitelline membrane. The following are the measurements of the largest specimen :—

Total length	225 mm.
Round the thickest part	38 mm.
Tail	30 mm.
Fang along the outer curve	5 mm.

The parent exhibits little concern about her offspring and interference with them extorted from her nothing more savage than a prolonged hiss. In the newly-born male specimens, the copulatory sacs are external and are four cœcal outgrowths.[3] The colouration of the young ones differ from the adults in certain particulars and the more interesting of them refer to a large diamond-shaped mark on the head, edged with white. A conspicuous white cross on the head behind this blotch is another interesting feature. It may be noticed that in the adults, the former practically disappears and the latter broadens out into a chocolate brown patch on the occiput. The dark rings (thrown into relief by a white outer border) in the adult enclose oval brown areas, but in the newly-born specimens, the rings are solid, black, oval or circular patches edged with white or may enclose dark reddish patches. The lower chin is tipped with black and the throat mottled. The circular marks on the mid dorsal line may or may not run together, though in the adult, they may remain separate.

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[1]. Fitz Simons gives the same period in the case of the puff adders of S. Africa. (*Vide* p. 222, South Afr : Snakes). Major F. Wall gives the same period. (Journ. Bombay Nat. Hist. Soc., Vol. XVIII)

[2]. The occurrence of unfertilised eggs anterior in position to those in advanced state of development in the enlarged oviducts (Uteri) is not uncommon in the Daboia. Such a condition was noticed when a gravid female was dissected sometime ago.

[3]. Specimens illustrative of all these facts have been sent to the Director Zoological Survey of India, Calcutta.

The young ones move very sluggishly and drink milk when offered, as soon as they have cast off the skin.

C. R. NARAYAN RAO,
Professor of Zoology.

CENTRAL COLLEGE, BANGALORE,
19*th June* 1917.

No. XIV.—EXCEPTIONALLY LARGE SAW SCALED VIPER (*ECHIS CARINATA*).

Whilst our men were digging on the Mohmand blockade line in December, we got four *Echis carinata* in one mound and an earth snake and what looked like a buff-striped keel-back.

The previous day we got three *Echis*. Several were killed daily, so they are very numerous near Shabkadr. I believe we told you of the 31 inch *Echis carinata* killed by Major Rennick near Mascat in 1915? It was seen and measured by several of us.

F. F. MAJOR, LT.-COL.,
95th Russell's Infantry.

NOWSHERA, N. W. F. P.,
18*th February* 1917.

No. XV.—NOTES ON AN INTERESTING SPECIMEN OF THE SEA SNAKE (*HYDROPHIS CÆRULESCENS*).

On the 2nd June 1917, I obtained from the fishing nets at Colaba a specimen of this snake which proved to be a gravid female. It was 2 feet 4 inches in length of which the tail accounted for 2½ inches. The lepidosis is typical. The costals numbered 40 at a point, 2 headslengths behind the head, 49 in mid body, and 43 at a point 2 headlengths before the anus. The ventrals number 316. As is usual in this species the parietals did not find contact with the postoculars on either side.

The chief interest attaching to the specimen was the retention in the abdomen of a withered fœtus some 4 inches long in the posterior ovary. This contained in the usual sac, was intimately adherent to the walls from which I had much difficulty in separating it. The folds of the fœtus were also adherent, and the young embryo in a state of degeneration, with both cephalic and caudal extremities maldeveloped. The anterior ovary contained 3 fertilised ova about half an inch or more in length.

It seems clear that the withered fœtus was a product of last year's conception, and that it had died, and been retained in the abdomen where it was undergoing degeneration. The eggs were obviously the result of this year's mating.

F. WALL, LIEUT.-COL., I.M.S.

BOMBAY, 4*th June* 1917.

No. XVI.—A LARGE CARP FROM THE EUPHRATES RIVER.

I am sending the Museum by means of a Captain of one of the ships that call here a skin of a fish caught in the Euphrates at Hakika.

This fish was 215 lbs. in weight, 6′-4″ long and 3′-10″ in girth.

It was speared by an Arab while lying at the bottom of the river about the month of September last year. It is the large mouthed, silver-coloured fish which we usually call the "Euphrates Salmon." It has two barbels on each side of the mouth and the Arab calls it *Gatan.* I hope you will get the skin safely.

W. A. LIGHT, MAJOR,
MESOPOTAMIA, 16*th April* 1917. 114th Mahrattas.

[The fish is *Barbus scich.*—EDS.]

No. XVII.—THE PACKING OF PAPERED BUTTERFLIES FOR SAFEKEEPING OR DESPATCH BY POST.

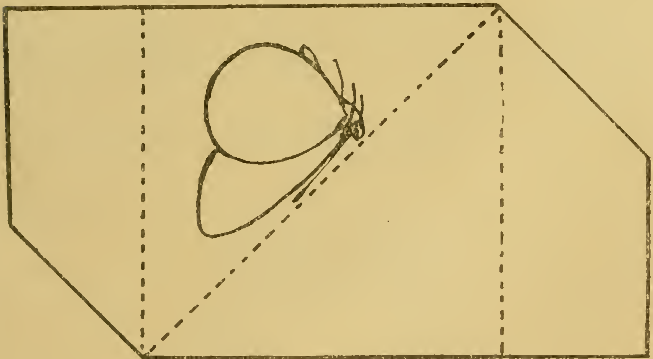
As set butterflies easily become damaged during transport from one place to another, some collectors in India keep their specimens in papers until able to set them in England.

Many collectors seem to take remarkably little trouble to preserve their papered specimens from damage; and as a little care in packing would mean all the difference between pleasure and disappointment on receiving specimens, a fellow-collector has persuaded me to send this note in case my method of packing specimens, which I have employed for some eight years past, may be of use to others.

A. Papering specimens.

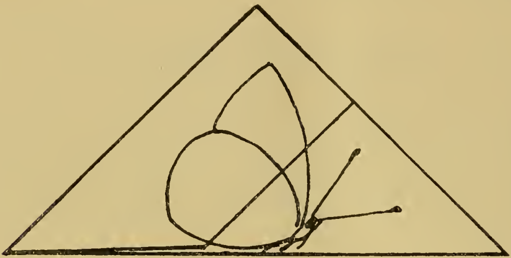
Standard sizes of paper-triangles should be used. For small and medium sized butterflies semi-transparent butter-paper is best, as it enables the contents to be seen through the paper at a glance, and guards against spread of any grease that may form. For large triangles use stronger glazed paper such as that of English illustrated weeklies, as glazed paper does not rub the scales off the wings.

Place the newly captured butterfly with the antennæ close against the forewings and at the fold of the paper, so that they dry in that position



3. Paper for Medium Paper triangle.
Fold at dotted lines.
Butterfly placed with antenna safe.

safe from injury (see sketch 3). Do not place it with body against the fold (see sketch 4) as in this position the antennæ almost always dry sticking out and eventually get broken off in handling the paper or specimen.



4. Paper triangle closed.
Butterfly unsafely placed.

If papered butterflies be massed together in a box any particular specimen cannot be got at without many being handled, resulting in damage to some sooner or later.

B. *Making Packets for papered specimens.*

The paper triangles should be kept in packets of corresponding standard sizes, so that these packets, fitting closely in an ordinary biscuit-tin, economise space and enable any one packet to be easily taken out without disturbing its contents.

The paper triangles should be so placed in a packet that the bodies of the specimens are alternately to left and right and so lie evenly; if not so placed they form a lopsided pile, and space is wasted and pressure is all on one side.

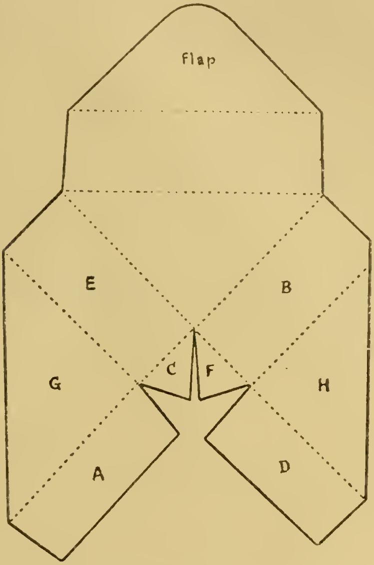
All packets should be of uniform height,—1 inch—so forming 2 or 3 tiers in the tin according to the kind of biscuit-tin used; and each packet should contain just so many specimens as not to be loose in it, and then the vertical sides of the packets take any weight or pressure.

A medium sized packet has its longest side about 3½ inches; larger packets can be made double, or smaller ones half the size of this one. Stout paper such as Parchment-note answers best.

Attached is an outline pattern (reduced half size) for making such a packet (Fig. 1). Cut along the outside continuous lines, and fold backwards at the dotted lines. This pattern may be used for outlining others with a pencil, keeping the centre portion of the pattern fixed with the fingers of the left hand, and turning up each portion after outlining as one works inwards. Paste A to underside of B so that C is between the two; then paste underside of D on to E with F between them. To close the packet inset the flap between G and H. A number of these outlined and cut out for packets, but not folded, can be kept ready to be made up into packets as they are wanted.

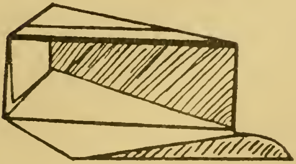
The pattern for packets should be of tough paper so that it will last a long time, and if some coloured paper be used for it the pattern will not get pasted together for a packet in mistake for one outlined from it.

The lower sketch (Fig. 2) shows an open completed packet.



(reduced half size.)

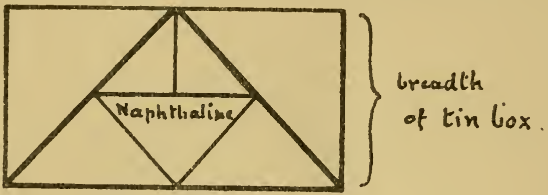
1.



2.

Diagram 5 shows an arrangement of three sizes of packets, say in the uppermost tier in a small biscuit-tin, a space in the middle being conveniently left for naphthaline.

Each packet is numbered and a list of contents pasted on the outside of the tin. Finally the tin is closed against damp and insects by a strip of 1 inch adhesive plaster all round the edge of the closed cover.



5. Arrangement of Packets in Tin box.

C. *For despatch by post.*

Tin boxes must be enclosed in a wooden one or they will be crushed For sending 50 specimens or less small boxes made from cigar-box wood, taking a few packets only, and with a diagonal partition inside to prevent the top or bottom being crushed in, are useful.

Put postage-stamps on a tie-on label, *not* on the box.

BANNU, N.W.F.P.,
1st *March* 1917.

H. D. PEILE.

No. XVIII.—NOTE ON THE COLOUR OF FLOWERS IN *DYSOPHYLLA STELLATA*, BTH.

This species of *Dysophylla* is very common in South India and has purple flowers and staminal hairs in nature. The plant is apparently very variable in appearance so much so that Cooke in his *Flora of Bombay* includes the species *D. gracilis* and *D tomentosa* of the *Flora of British India* as mere varieties of *D. stellata*. Recently specimens collected by me at Talaguppa in the extreme Western Ghats of Mysore showed a few plants of *D. stellata* with absolutely white flowers and white staminal hairs. In one of Wight's sheets in the Madras Herbarium (now at Coimbatore) the corolla is white and the stamens pink. This variation in colour of flowers has also been noted by Mr. Rangachari in *Asystasia coromandeliana* (yellow and white flowers) in *Striga lutea* (white, yellow, pink and brown corollas) and by Mr. Tadulingam in *Evolvulus alsinoides* (blue and white flowers). While the colour variation in the above plants is a common feature, the white flowered type in *Dysophylla* has been very rare. The few specimens collected by me were in a mass of the pink flowered specimens and no intermediates were observed by me. There is another minor difference in the colour of the stem near the inflorescence between the two types, the white flowered type being comparatively white or slightly pink. I therefore propose the name *Dysophylla stellata*, var. *alba* for the new plant.

M. K. VENKATA RAO,
Senior Assistant Mycologist.

BANGALORE, 6*th March* 1917.

No. XIX.—AN INTERESTING CASE OF DISTRIBUTION.

The genus *Pogonia* of the Orchideæ has two species growing in the Bombay Presidency, *P. carinata*, Lindl., and *P. plicata*, Lindl. In June last, I found an orchid near Koppa, Kadur District (Western Ghats of Mysore), which when sent to Coimbatore was identified as *Pogonia prainiana*, King and Prantling. This orchid has not hitherto been described in Mysore or the Bombay Presidency. Its occurrence in Mysore and its absence in the neighbouring country is a remarkable instance of distribution.

M. K. VENKATA RAO,
Senior Assistant Mycologist.

BANGALORE, *6th March* 1917.

No. XX.—FALL OF SEED IN RAIN STORM.

On the night of April 12th last there was a heavy rain storm over a widespread area of the Junagadh State registering from 20 to 75 cents in the various villages. Over the whole area the rain was accompanied by a fall of seed locally known as Lal Jowari (or red jowari). I enclose a specimen of the seed collected.

The phenomenon is recognised by the villagers and in their opinion presages a fine season and generally good luck.

This seed does not occur in Kathiawar and must have been blown in from some neighbouring province. I am informed by the oldest Jain priest here that such falls occur at intervals of five or seven years and are invariably followed by a bumper season. Perhaps some of our members may have noticed similar occurrences in other parts of the country?

E. BROOK-FOX.

JUNAGADH, KATHIAWAR,
17th April 1917.

[The seed sent is a variety of *Sorghum vulgare*. Pers.—EDS.]

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS.

PROCEEDINGS

OF THE MEETING HELD ON 1st MARCH 1917.

A Meeting of members and their friends of the Bombay Natural History Society took place on Thursday, 1st March 1917, the Hon'ble Mr. Justice N. C. Macleod presiding.

The election of the following 13 members since the last meeting was announced :—Mr. G. G. Fletcher, Bombay; Mr. Fred. Hallberg, Bombay; Mr. E. G. Barter, I.C.S., Salem; Capt. E. J. Cumming, Ahmednagar; Mr. S. A. C. Green, I.C.S., Shahbandar; Mr. J. M. Conder, I.C.S., Kawkareik: Capt. W. B. M. Newland, I.M.S., Mesopotamia; Mrs. C. Fowler, Bombay; Major J. Husband, I.M.S., Bombay; The Honorary Secretary, Vellore Club, Vellore; Miss M. R. N. Holmer, M.A., Delhi; Capt. C. M. Thornhill, Mesopotamia. and Major Robert E. Wright, I.M.S., Bombay.

ELECTION OF THE COMMITTEE.

The following gentlemen were elected as office-bearers for the present year :—*President.*—H. E. The Right Hon'ble Lord Willingdon, G.C.I.E.; *Vice-Presidents*—Mr. J. D. Inverarity, the Hon'ble Mr. Justice N. C. Macleod and H. H. The Rao Saheb of Cutch, G.C.I.E. *Managing Committee*—Mr. T. Bainbrigge Fletcher, F.E.S.; Mr. T. R. Bell, I.F.S.; Mr. C. L. Burns; Rev. E. Blatter, S.J.; Mr. E. Comber, F.Z.S.; Lt.-Col. G. H. Evans, C.I.E.; Major M. L. Ferrar; Capt. F. C. Fraser, I.M.S.; Prof. G. A. Gammie, Mr. F. Hannyngton, I.C.S.; Mr. G. S. Hardy, I.C.S.; Prof. V. N. Hàte; Mr. N. B. Kinnear; Lt.-Col. K. R. Kirtikar, I.M.S. (Retd.); Major W. Glen Liston, C.I.E., I.M.S.; Mr. F. M. Mackwood; Mr. L. H. Savile; Mr. R. A. Spence; Lt.-Col. F. Wall, C.M.G., I.M.S., C.M.Z.S.; Mr. John Wallace, C.E. *Honorary Secretary*—Mr. W. S. Millard. *Honorary Treasurer.*—Mr. L. Robertson, C.S.I, I.C.S.

CONTRIBUTIONS.

Contribution.	Locality.	Donor.
1 Persian Mungoose, *Mungos persicus.* 1 Syrian Hedgehog, *Erinaceus calligoni.* 2 Babylon Sheath-tailed bats, *Taphozous babylonica.* 1 Mouse, *Mus sp.* 3 Shrews, *Crocidura sp.* 1 Caspian terapin, *Clemmys caspica.* 11 Snakes .. .. .. 3 Lizards .. .. .. 1 Toad .. .. 1 Scorpion .. .. .. 1 Cockroach	Mesopotamia ..	Lt.-Col. F. Wall, I.M.S., C.M.G.
4 Tibetan Hare, *Lepus tibetanus*..	Wano, Waziristan	Capt. W. B. Cotton.
1 Jungle Cat, *Felis chaus* (alive) 11 Birds	Mesopotamia ..	Col. Sir P. Z. Cox.

Contribution.	Locality.	Donor.
1 Jackal, *Canis aureus*	Kut, Mesopotamia	Capt. C.R.S. Pitman.
4 Hares, *Lepus sp.*		
11 Birds		
1 Syrian Hedgehog, *Erinaceus calligoni.*	Mesopotamia ..	Mr. J. M. S. Culbertson.
1 Little Grebe, *Podiceps albipennis.*	Do. ..	Capt. R. Bagnall.
1 Smew, *Mergus albellus* ..		
1 White-fronted Goose, *Anser albifrons.*		
1 Tatera *sp.*		
1 Jungle Cat, *Felis chaus* ..	Do. ..	Lieut. Brewster.
1 Large Spotted Eagle, *Aquila maculata.*	Legait, Mesopotamia.	Lieut. T. R. Livesey.
1 Panther, *Felis pardus* ..	Mekran	Capt. J.E.B. Hotson.
3 Foxes, *Vulpes sp.*		
3 Mungoses, *Mungos mungo* ..		
2 Porcupines, *Hystrix sp.* ..		
1 Persian Hare, *Lepus craspedotis.*		
1 Gazelle		
1 Palm Squirrel, *Funambulus pennanti argentescens.*		
8 Snakes		
48 Birds		
1 Indian Jungle Cat, *Felis affinis*..	Nowshera ..	Major W. H. Lane.
1 Wood-Snipe, *Gallinago nemoricola*	Thana, Bombay ..	Major M. L. Ferrar.
1 Sheldrake, *Tadorna cornuta* ..	Larkana, Sind ..	Mr. G. A. Shillidy.
1 Grey's Snake, *Zamenis ventrimaculatus.*	Muscat	Major L. Haworth.
2 Wild Dogs, *Cuon dukhunensis* juv (alive).	Narsinghpur ..	Mr. P. S. Patuck, I.C.S.
1 Painted Stork, *Pseudotantalus leucocephalus.*	Delhi	Mr. W. E. Ashton James.
1 Bar-headed Goose, *Anser indicus.*	Nowshera ..	Major C. W. Prescott.
3 Yellow-legged Herring-gull, *Larus cachinans.*	Bombay	Mr. S. H. Prater.
2 Dark-backed Herring-gull, *Larus affinis.*		
2 Brown-headed Gull, *Larus bruneicephalus.*		

COLLECTION OF PLANTS.

With reference to the collection of plants which Capt. Hotson had for about a year, been sending to the Society from Persian Baluchistan, the Revd. E. Blatter made some interesting observations. In the course of his remarks he said:—His collections are of great interest to the student of ecology as well as of plant geography. Persian Baluchistan is virgin soil for the botanist, as no collections have ever been brought home from that region. There have been travellers passing through that country, yet botanical science has not profited by them. We know a good deal about the flora of British Baluchistan (*i.e.*, British Baluchistan proper, the Agency Territories, and the Native States of Kalat and Las Bella). William Griffith Superintendent of the Hon. East Indian Company's garden at Calcutta, was the first to collect in Baluchistan. In November 1839, he joined the Army of the Indus in a scientific capacity, and penetrated, after the subjugation of Kabul, beyond the Hindu Kush into Khorasan, whence, as well as from Afghanistan and Baluchistan, he brought collections of great value and extent. In 1843 a book appeared entitled "Narrative of a Journey to Kalat," written by Masson, a surgeon. It contains numerous botanical references but on the whole it is more the book of an adventurer than of a botanist. The second botanist who visited Baluchistan was Dr. J. E. Stocks. In 1848, he crossed the Hab River and reached Shah Bhilawal. In 1850, he made another and longer trip into the country *via* Shikarpur and the Gundava Pass to Kalat, Quetta and Nushki. Between 1877 and 1880 extensive collections were made by Doctors O. T. Duke and Hamilton. Their plants were preserved at the Royal Botanic Garden, Calcutta. A few years later (1884-1885) we find Dr. J. E. Aitchison attached to the Afghan Delimitation Commission. He collected between Quetta and the Helmand river along the northern border of Baluchistan, and his results are embodied in the "Botany of the Afghan Delimitation Commission," which was published in the Transactions of the Linnean Society. Of more recent botanists who increased our knowledge of the Baluchistan flora we must mention J. H. Lace who was stationed in that country from 1884 to 1888 as Deputy Conservator of Forests, besides, J. S. Duthie, at the time Director of the Botanical Department of Northern India. He collected chiefly near Quetta on a visit to Baluchistan in 1888; and finally Lieut.-Colonel F. P. Maynard who, in 1896, accompanied the Baluch-Afghan Boundary Commission as medical officer. The results were published by I. H. Burkill and D. Prain in the records of the Botanical Survey of India (1897). Whatever in the way of publications, or specimens had been contributed towards the botanical exploration of Baluchistan during a period of 70 years, was collected and examined by I. H. Burkill and published in his "Working List of the Flowering Plants of Baluchistan" (1909). His final conclusion is that "the flora of Baluchistan is Persian in character, and very much less northern than that of Afghanistan; but it is northern enough to contain a violet, a primula, the English hawthorn, an anemone, a gentian, a juniper and plants of many genera familiar in north-western Europe."

So far we possess a fair knowledge of the country lying east of Persian Baluchistan. Much less is known of the parts adjoining it on the west, namely, of Persia proper. In the Northern Provinces of Gilan, Mazandaran, and Astarabad on the Caspian, from the shore to an altitude of about 3,000 ft. on the northern slopes of the great mountain range which separates those provinces from the high lands of Persia, the flora is similar to that of the Mediterranean region. At higher altitudes many forms of a more northern flora appear. As we approach inner Persia, the flora rapidly makes place to steppe vegetation in the plains, while the Mediterranean flora predominates in the hills. The steppe vegetation extends in the south to the outer range of the hills which separate inner Persia from the Persian Gulf and the Indian Ocean. Beyond this outer range and along the shore of the sea, the flora is that of the Sahara region which extends eastwards to Sind.

I need not point out that the conclusion arrived at by Burkill applies to the flora of Baluchistan as a whole, and it is easy to see what the verdict will be if we distinguish, *e. g.*, a northern and southern sub-region and compare their respective floras with each other. The northern part will be more Afghan, whilst the southern part, (Brit. Makran), will show a greater resemblance to the Sind flora of the Indus region. The question, therefore, remains, whether Persian Baluchistan should be considered as part of the connective link between the desert region of N. Africa and Arabia on the one hand and Sind on the other? Captain Hotson's collections, together with what we know of the physical geography of the country, enable us to form a distinct idea of the plant, geographical position of the vegetation of Persian Baluchistan. The composition of the flora and its morphological and anatomical characters point to the conclusion that it belongs to the North-African-Indian desert, containing at the same time in the regions of higher altitude a number of types characteristic of the Mediterranean flora.

REPORT OF THE HONORARY TREASURER ON THE ACCOUNTS FOR 1916.

Mr. L. Robertson, C.S.I., I.C.S., the Honorary Treasurer said:—

I have much pleasure in presenting the Accounts for 1916.

At the end of 1915, we had balance in hand of Rs. 5,686, inclusive of Rs. 5,000 in Fixed Deposit.

The year closes with a balance of Rs. 5,702 inclusive of a Fixed Deposit of the same figure as above, Rs. 5,000.

In addition to the above working balance, the Society owns certain investments. These amounted at the beginning of the year to Rs. 43,000, at the end of this year this sum amounted to Rs. 47,800, an advance of Rs. 4,800. Our investments included a sum of Rs. 14,000 in 3½ per cent. Government paper. When the Conversion Loan was issued last year, Mr. Millard and I had several consultations and we decided that it was in the interests of the Society to convert as much of our 3½ per cent. paper as our resources would admit. Accordingly we bought Rs. 5,000 worth of the New Loan and were able to convert Rs. 5,200 of our 3½ per cent. paper into 4 per cent. paper. Thus the invested balance now includes only Rs. 8,800 of 3½ per cent. paper, while we now hold Rs. 10,000 New 4 per cent. Loan. This operation has, I think, added materially to the resources of the Society. The remainder of our invested balance consists of Rs. 14,000 of 4 per cent. Bombay Port Trust Unguaranteed Bonds and Rs. 15,000 City of Bombay Improvement Trust Bonds. I have stated all these figures at the face value of the paper. Of course the market value is at the present time much depreciated. There appears, however, to be no reasonable probability that we shall have to sell the Securities which now bring in an income of Rs. 1,868 a year.

I have said that there is no reasonable probability of our having to sell these Securities for this reason.

The financial prospects of such a Society as ours, depends almost entirely on the number of members. Last year I remarked that it was necessary to increase the number of members. I find from the Accounts that the income from subscriptions, entrance fees and Life Membership fees was Rs 21,695 against Rs. 21,163 last year, which is a slight advance.

I see that our Secretary has collected many arrear subscriptions inclusive of one outstanding since 1912. On the other hand one generous gentleman has already paid ⅓ of his subscription for 1918.

We have received our annual grant of Rs. 5,000 from the Government of Bombay on which, I think, in these days of War parsimony we may congratulate ourselves.

Turning to the Mammal Fund Accounts I find that we have increased our balance from Rs. 8,526 to Rs. 9,333. Of course we have not appealed for subscriptions; but we have actually received Rs. 2,433 in donations. Only one Collector, Mr. Baptista, has been working. All our English Collectors have joined the Army. Mr. Baptista has recently gone to work under Capt. Hotson who, as you know, joined the Indian Army. When the War is over and we can get our English collectors back again, it will be necessary to make an energetic appeal for funds.

I think the members will agree that in the circumstances the funds of the Society have been satisfactorily administered.

PROCEEDINGS OF THE MEETING HELD ON 1st MAY 1917.

An "At Home" of members and their friends of the Bombay Natural History Society took place on Tuesday, the 1st May.

The election of the following 11 new members since the last meeting was announced:—Lt. C. H. Delmege, R.E., Bangalore; Mr. Trimbak Govind Yeolekar, Poona; Mr. Ralph Randles Stewart, Rawalpindi; Lt.-Col. H. M. Halliday, Summerpur, Rajputana; Mr. William Whyte, Rangoon; Rev. F. C. B. Jourdain, Europe; Major C. W. Prescott, I.A., Nowshera; C. H. Hutton, Esq., Srinagar; Rev. W. M. Zumbro, Madura; Mrs. M. C. Arundel-Barker, Garhwal, and Mr. F. G. Butler, I.C.S.

CONTRIBUTIONS.

The Society is once again indebted to its members serving with the forces for a large part of its contributions since the last meeting. From Capt. J. E. B. Hotson, I.A.R.O., comes a collection of 43 mammals, 27 birds and several snakes, lizards, etc., obtained in Persia. From Mesopotamia Capt. Pitman, always busy on our behalf, sent us two short-eared owls, 4 spanish sparrows, a common bunting and a desert chat, while Lt. Livesey procured for us a European roller, a blue-cheeked bee-eater, and the skin and skull of a jackal, a most welcome contribution as the Society is anxious to obtain a series of skins and skulls of these animals from Mesopotamia and Persia. Col. Stevens presented us with a teal, a bittern, and one Eastern Baillon's crake. From Capt. Armitage, R.N.R., the Society has received two Sooty or Hemprichs gulls from Aden, a very welcome addition to our collection as this species has been very poorly represented hitherto. Another of these birds was obtained for us at Muscat by Major Husband, I.M.S., while two tesselated water snakes, two Gray's rat snakes, and a dozen scorpions were received from Basra from Col. Anderson.

From within "Indian" limits the Society received a very interesting little collection of mammals from Mr. P. M. R. Leonard obtained on the Burmo-Chinese Frontier, among these were four handsome flying squirrels and a golden cat, two cat bears and two weasels. Mr. C. W. Allen sent us a large Indian civet and a jungle cat from Henzada, whilst a second specimen of the former was together with a Phayres leaf monkey and two Malay vampires obtained for us by Mr. F. C. Purkis of Magwe. A bar-tailed cuckoo-dove from Mr. W. Hannyngton, Shwebo, and an imperial pigeon and Burmese ring dove from Mr. F. Atlay, Mogok, complete the contributions received from Burma.

Mr. C. H. Dracott sent in a leopard cat and a marmot from Sikkim, the latter skin was damaged, which is unfortunate as specimens of this animal from Sikkim and Tibet are amongst the Society's "wants." A Solitary

Snipe came in from Mr. J. C. Higgins, I.C.S., of Manipur and a Water Cock from Mr. L. O. Clarke, Dibrugarh, Assam.

The Society is much indebted to Mr. H. D. Baskerville, I.C.S., for the skin and skull of a small Indian civet shot in Sind and likewise to Messrs. D. O. Witt and G. Evans for specimens of this animal from Chanda and Jubbulpore respectively. At the request of Mr. R. C. Wroughton, the Society has made special efforts to obtain this civet from Sind and the C. P. A second bittern was sent to us by Mr. F. J. Mitchell, Kashmir, and Major Norman sent down a fine example of the black-tailed Godwit. One John's earth snake was also received from Poona from Major W. S. J. Shaw, while Major H. R. Watson presented us with the head of a cobra in which the "cuneate" scale is wanting.

The Secretary acknowledged the following contributions to the Museum since the last meeting:—

Contribution.	Locality.	Donor.
1 Indian Civet (*Viverra zibetha*)	Henzada	Mr. C. W. Allan.
1 Jungle Cat (*Felis affinis*)		
1 Golden Cat (*Felis temmincki*)	Burmo-Chinese-Frontier.	P. M. R. Leonard.
1 Red Cat-bear (*Ailurus fulgens*)...		
1 Burmese Tiger-Civet (*Prionodon maculosus*).		
2 Weasels		
4 Flying Squirrels (*Petaurista sp.*).		
4 Rats		
2 Squirrels (*Sciurus sp.*)		
1 Water Shrew (*Nectogale sp.*)		
1 Blood Pheasant (*Ithagenes kuseri*)		
1 Jackal (*C. aureus*)	Shaiba, Mesopotamia.	Lieut. T. R. Livesey.
1 Blue-cheeked Bee-eater (*Merops persicus*).		
1 Roller (*C. affinis*)		
1 Small Indian Civet (*V. malaccensis*).	Chanda, C. P.	Mr. D. O. Witt.
1 Small Indian Civet (*V. malaccensis*).	Karachi Dist.	Mr. H. D. Baskerville.
1 Small Indian Civet (*V. malaccensis*).	Jubbulpore	Mr. G. Evans.
1 Marmot (*Arctomys sp.*)	Sikkim	Mr. C. H. Dracott.
1 Leopard Cat (*F. bengalensis*)		
1 Phayres Leaf Monkey (*P. phayrei*).	Magwe	Mr. F. C. Purkis.
1 Burmese Palm Civet (*Paradoxurus burmanicus*).		
2 Malay Vampire Bats (*Megaderma spasma*).		
1 Green Imperial Pigeon (*Carpophaga ænea*).	Mogok	Mr. F. Atlay.
1 Burmese Ring Dove (*Streptopelia xanthocycla*).		
2 Sooty Gulls (*Larus hemprichi*)	Aden	Capt. Armitage.

Contribution.	Locality.	Donor.
1 Bittern (*Botaurus stellaris*)	Mesopotamia	Col. H. Stevens.
1 Teal (*Nettium crecca*)		
1 Eastern Baillon's Crake (*Porzana pusilla*).		
2 Short-eared Owls (*A. accipetrinus*).	Do.	Capt. C. R. S. Pitman.
4 Spanish Sparrows (*P. hispaniolensis*).		
1 Bunting (*Emberiza sp.*)		
1 Corn Bunting (*E. milaria*)		
1 Falcated Teal (*E. falcata*)	Delhi	Major A. H. Cunningham.
1 Solitary Snipe (*G. solitaria*)	Imphal, Manipur	Mr. J. C. Higgins, I.C.S.
1 Water-cock (*Gallicrex cinerea*)	Dibrugarh	Mr. L. O. Clarke.
1 Bittern (*Botaurus stellaris*)	Kashmir	Mr. F. J. Mitchell.
1 Bar-tailed Cuckoo Dove (*Marcopygia tusalia*).	Shwebo	Mr. W. O. Hannyngton.
1 Sooty Gull (*L. hemprichi*)	Muscat	Major J. Husband.
1 Black-tailed Godwit (*L. belgica*).	Risalpur	Major A. C. Norman.
1 John's Earth Snake (*E. johnii*)	Poona	Major W. S. J. Shaw, I.M.S.
1 Cobra (*N. tripudians*)	Nowshera	Major H. R. Watson.
2 Tessellated Water Snakes (*T. tesselatus*).	Mesopotamia	Lt.-Col. Anderson.
2 Gray's Rat Snakes (*L. ventrimaculatus*).		
12 Scorpions		
42 Mammals	Charbar	Capt. J. E. B. Hotson.
26 Birds		
16 Snakes		
Lizards and some Insects		

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT of ACCOUNTS from 1st January 1916 *to 31st December* 1916.

RECEIPTS.	Rs. a. p.	Rs. a. p.
To BALANCE ON 31ST DECEMBER 1915—		
Cash with the National Bank of India, Ld...	591 10 9	
Fixed Deposit with Eastern Bank, Ld. ..	5,000 0 0	
Balance per Postage Book..	45 5 3	
" " Petty Cash Book	49 2 8	
		5,686 2 8
To Subscription for 1912 (in arrears)	15 0 0	
" " " 1913 "	15 0 0	
" " " 1914	75 0 0	
" " " 1915 "	840 10 0	
" " " 1916 current year	19,471 10 9	
" " " 1917 (in advance)	652 2 2	
" " " 1918 "	5 0 0	
" " " Life Membership ..	800 0 0	
	21,874 6 11	
Less—Refund of Subscription.. ..	179 12 0	
		21,694 10 11
Entrance Fee	870 0 0	
Sale of Journals	1,394 10 3	
" Snake Books	1,823 13 6	
" Wood Destroying White Ants Books.	2 10 0	
" Catalogue of Library	2 0 0	
" Duck Book	50 0 0	
" Pigeon Books	254 0 0	
" Flora of Matheran	5 4 0	
" List of Butterflies..	2 4 0	
Carried over ..	Rs. 4,404 9 9	Rs. 27,380 13 7

PAYMENTS.	Rs. a. p.	Rs. a. p.
By Journal Account	14,183 10 11	
" Salaries..	7,428 2 9	
" General Charges	1,122 5 4	
" Rent	2,640 0 0	
" Printing and Stationery	663 5 3	
" Petty Cash Expenses..	399 2 9	
" Postage Expenses	498 10 3	
" Library Account	150 3 0	
" Furniture "	302 14 6	
" Sundries	138 5 9	
" Auditor's Fee	130 0 0	
" Insurance	140 10 0	
" Bank Charges	60 9 0	
" Income Tax	89 5 5	
" Methylated Spirit	631 11 0	
		28,578 15 11
" Investment in 4% New Conversion Loan ..		5,000 0 0
Balance—		
Fixed Deposit with the Mercantile Bk. of India.	5,000 0 0	
Balance as per Postage Book	32 14 6	
" " Petty Cash Book	49 15 11	
" with the National Bank of India, Ld...	618 14 7	
		5,701 13 0
Carried over ..		Rs.39,280 12 11

STATEMENT of ACCOUNTS from 1*st January* 1916 *to* 31*st December* 1916—*contd.*

RECEIPTS.	Rs. a. p.	Rs. a. p.	PAYMENTS.	Rs. a. p.	Rs. a. p.
Brought forward ..	4,404 9 9	27,380 13 7	Brought forward ..	......	39,280 12 11
Grant-in-aid from the Bombay Government ..	5,000 0 0				
Registration fee on Journals	78 8 0				
Sundries	225 13 2				
Interest on Investments	1,651 4 6				
Interest on Fixed Deposits	236 4 0				
Interest on Current Account	115 9 6				
Shipping expenses recovered	187 14 5	11,899 15 4			
Total ..		Rs.39,280 12 11			39,280 12 11
			Securities with the National Bank of India, Ld.—		
			3½ % Government of India Pro. Notes ..	8,800 0 0	
			4 % Government of India Conversion Loan.	10,000 0 0	
			4 % Bombay Port Trust Unguaranteed Bonds	14,000 0 0	
			4 % City of Bombay Improvement Trust Bonds	15,000 0 0	
			Total ..	Rs.47,800 0 0	

We have seen a letter from the National Bank of India, Limited, to the effect that the above Securities were held on the Society's behalf on the 31st December 1916.

Examined and found correct.

(Sd.) L. ROBERTSON,
Honorary Treasurer

(Sd.) A F. FERGUSON & Co.,
Chartered Accountants, Auditors.

BOMBAY, 26*th February* 1917.

BOMBAY NATURAL HISTORY SOCIETY.

MAMMAL FUND ACCOUNT.

STATEMENT of ACCOUNTS from 1st January 1916 *to* 31*st December* 1916.

RECEIPTS.	Rs. a. p.	Rs. a. p.	PAYMENTS.	Rs. a. p.	Rs. a. p.
To BALANCE ON 31ST DECEMBER 1915					
Fixed Deposit with the Eastern Bank, Ld.	2,500 0 0		By Salary of Mr. N. A. Baptista, Collector ..	540 0 0	
Bombay Port Trust Unguaranteed Bonds of Rs. 5,000 at cost	5,150 0 0		,, Allowances	276 4 9	
Balance per Petty Cash Book	41 8 10		,, Travelling and Camp Expenses	91 12 6	
,, ,, Postage ,, ...	26 14 0		,, Clothes, &c.	26 0 0	
,, with the National Bank of India, Ld.	807 4 2	8,525 11 0			934 1 3
To Donations received during the year 1916 ..	2,433 4 0				
,, Interest on Fixed Deposits	100 0 0		By Collecting Expenses	113 0 9	
,, ,, on Current Account	19 2 4		,, Ammunition	36 0 0	
,, ,, on Investment	191 2 4		,, Salary of the Staff	170 0 0	
,, Cost of Gun sold	100 0 0		,, Auditors' Fee	30 0 0	
,, Amount refunded by Mr. Pillay	39 7 0	2,882 15 8	,, General Charges	281 14 3	
			,, Bank Charges	1 1 0	
			,, Insurance Premium on Specimens sent to B. M...	216 8 0	
Carried over ..		11,408 10 8	Carried over ..	848 8 0	934 1 3

Mammal Fund Account—contd.

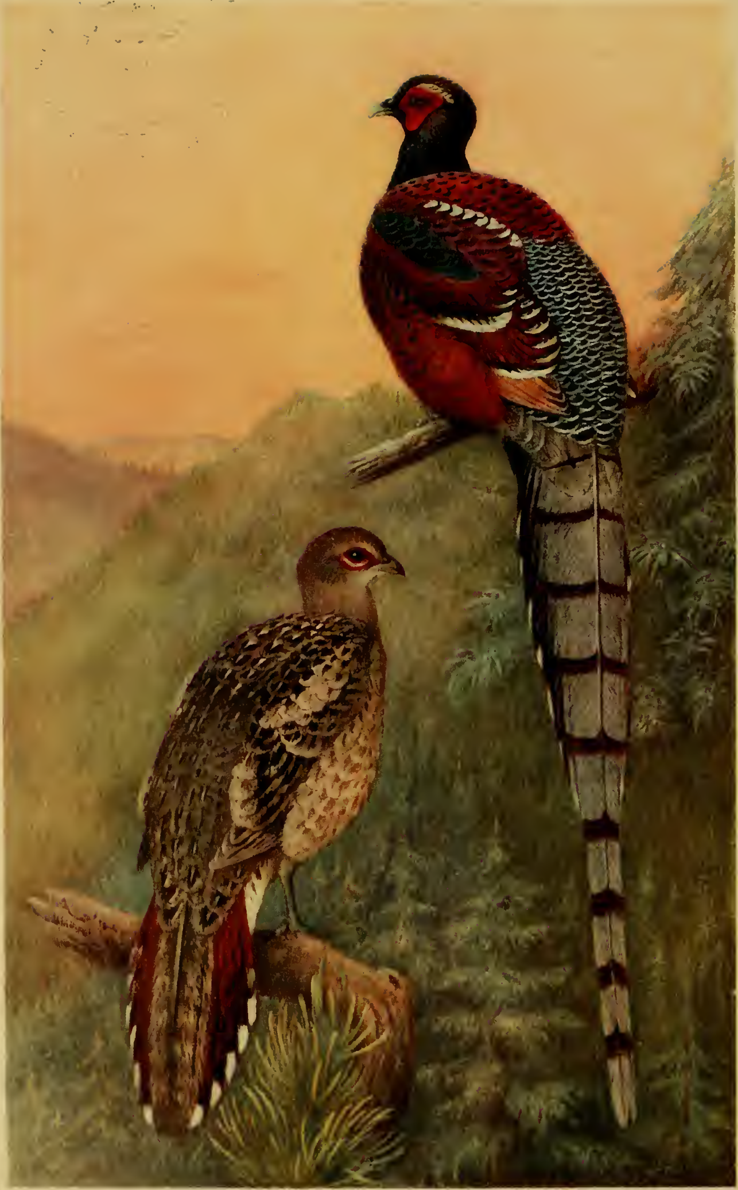
RECEIPTS.	Rs. a. p.	Rs. a. p.	PAYMENTS.	Rs. a. p.	Rs. a. p
Brought forward ..		11,408 10 8	Brought forward ..	848 8 0	934 1 3
			By Income Tax	6 8 2	
			,, Rewards, &c.	214 0 0	
			,, Postage Expenses	19 4 6	
			,, Petty Cash Expenses	53 8 0	
					1,141 12 8
			By Balance—		
			Fixed Deposit with the Eastern Bank, Ld. ..	3,500 0 0	
			Bombay Port Trust Unguaranteed Bonds of Rs. 5,000 at cost	5,150 0 0	
			Balance per Postage Book	7 9 6	
			,, ,, Petty Cash Book	38 0 10	
			,, with the National Bank	637 2 5	
					9,332 12 9
Total ..		Rs.11,408 10 8			Rs.11,408 10 8

Examined and found correct.

(Sd.) L. ROBERTSON,
Honorary Treasurer.

(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, Auditors.

BOMBAY, 26*th February* 1917.



MENPES PRESS, WATFORD.

PHASIANUS HUMIÆ.

Mrs. Hume's Pheasant.

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS.

JOURNAL
OF THE
Bombay Natural History Society.

JAN. 1918. VOL. XXV. NO. 3.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L S., F.Z.S., M.B.O.U.

PART XXIII.

With a Coloured Plate.

PHASIANIDÆ.

Genus—*GENNÆUS.*

GENNÆUS LINEATUS LINEATUS.

The Burmese Silver-Pheasant.

Phasianus lineatus, Vigors, Phil. Mag. (1888), p. 147.

Gennæus lineatus, Oates, Str. Feath., V., p. 164 (1877); Ogilvie-Grant, Cat. B. B. M., XXII., p. 304 (1893); Id, Hand-List, Game-B., I., p. 272 (1895); Blanf., Fauna, B. I., IV., p. 92 (1898); Oates, Man. Game-B., I., p. 351 (1898); Id. Ibis, 1903, p. 100; Id, Cat. Eggs, B. M., I., p. 55, P. C. VI., Fig. 5 (1901); Ghigi, Mem and Acad, Bologna, 6, (V), p. 140 (1908); Evans, Bom. N. H. S. Journal, XVI., p. 520 (1905); Wall, Ibid, XXI., p. 460 (1912); Hopwood, Ibid, p. 1215 (1912).

Phasianus fasciatus, McClell, Calcutta, Jour. N. H., II., p. 146, Pl. III. (1842).

Euplocomus lineatus, Blyth, Cat. Mus. As. Soc. B., p. 244, part (1849).

Gallophasis lineatus, Hume, Str. Feath., II., p. 482 (1874).

Euplocamus lineatus, Hume, Nests and Eggs, In. B., p. 525 (1873); Id., Str. Feath., III., p. 165 (1875); Fielden, Ibid, p. 168 (1875); Hume and Marsh., Game-B., Ind., p. 205, Pl. (1878); Hume and Davis., Str. Feath., VI., p. 436 (1878); Anderson, Zool. W. Yunnan, II., p. 669 (1878): Bingham, Str. Feath., IX., p. 195 (1880): Oates, Ibid. X., p. 236 (1882); Id., B of Burma, II., p. 316 (1883); Id., 2nd Edit., Hume's Nests and Eggs, III., p. 416 (1890).

Lophophorus cuvieri, Hume, Str. Feath., III., p. 166 (1875).

Nycthemerus lineatus, Blyth and Walden, Cat. Mam. Birds of Burm., p. 149 (1895).

Euplocamus cuvieri, Oates, B. of Burm., II., p. 318, part (1883).

Gennæus lineatus lineatus, Gyldenstolpe, Swedish, Exped., Siam, p. 157 (1816).

Vernacular Names.—Yit, Kayit (*Burmese*); Rak (*Arrakan*); Synklouk (*Talain*); Phugyk (*Karen*).

Description—Adult Male.—Forehead, crown and crest black, glossed, especially on last, with blue-green or, more rarely, purple blue. Whole of the upper plumage, sides of the neck, wing coverts and exposed portions of the wing quills silver grey in general appearance, palest on the neck and longest tail coverts and darkest on the wing quills and greater coverts. The grey appearance is formed by innumerable fine wavy bars of white on a black ground, these being finest and most numerous on the neck and largest on the wing quills. The primaries are brown with wavy lines of buff or pale brown on both inner and outer webs, these gradually changing colour until the black and white of the inner secondaries is attained. The ends of the upper tail coverts have the white exceeding the black in extent, the longest being almost pure white at their tips. Outer tail feathers black with fine longitudinal lines of buff or buffy white, each succeeding pair having more white and less black, until the central pair, or two pairs, are more or less immaculate over the terminal two-thirds of their length, the fine black lines running further up on the outer than on the inner webs. Below from chin to tail coverts inclusive black, the neck, breast and sides of the flanks more or less glossed with bluish purple; sides of neck, breast and flanks with white centres to the feathers, these white streaks sometimes extending over the greater part of the breast and generally vermiculated with velvety black on the flanks.

Colours of the Soft Parts.—Iris brown, hazel or yellow brown; facial skin and lappets crimson, vivid crimson red or scarlet crimson; bill greenish or yellowish-horny, darker on the culmen and at the base as far as and surrounding the nostrils; legs and feet plumbeous, greenish plumbeous, slate grey, rarely with a greenish brown tinge.

> "The legs and feet were generally pinkish fleshy or pinkish "brown; sometimes a sort of bluish horny or plumbeous brown."
>
> "The irides seem to vary a great deal; some were brown, of "different shades, usually more or less tinged with red; others "are noted as very pale pink, or even fleshy white." (Hume.)

Measurements.—The series in the British Museum and other specimens which have passed through my hands, in all some 50 birds, shew an extraordinary variation in size, even in birds which are all undoubtedly adult.

Wing from 8·6″ (218·4 mm.) to 10·3″ (261·6 mm.); tail from 9″ (228·6 mm.) to 13·6″ (345·4 mm.); bill from front about 1·15″ (29·2 mm.) and from gape about 1·45″ (36·8 mm.); tarsus 3″ to

3·5″ (76·2 mm. to 88·9 mm.); the crest runs from about 2·5″ (65·5 mm.) to 3·2″ (81·2 mm.). The average wing measurement of this series is 9·5″ (241·3 mm.).

Hume's measurements given of birds measured in the flesh shew nearly as great variation as the above.

> "Length, 25·0 to 30·0; expanse 29·75 to 32·75; tail from "vent 10·0 to 13·5; wing 9·25 to 11·5; tarsus 3·0 to 3·62; "bill from gape, 1·35 to 1·5; weight 2·5 to 3·0 lbs."

Adult Female.—Whole upper surface of the plumage a golden brown formed by very fine wavy bars of black or blackish brown on a golden buff ground, varying on some birds to a reddish buff; crest rather darker than the rest of the upper plumage with the black bars broader and closer together; feathers of the neck and upper back with white V-shaped marks, narrowly bordered with black; these V-shaped marks are very irregular, and sometimes become mere central white streaks, especially on the upper back; wing coverts and exposed portions of the wing like the back, the primaries and outer secondaries brown on the inner webs. Two central pairs of tail feathers buff with narrow bars of black running across at an angle of about 45° to the shaft, but often practically absent over the terminal half of the inner web of the central pair; outer tail feathers rich chestnut with broad, but very irregular bars of white, bordered with black, and often spotted with the same; these feathers are also mottled with buff at the tips, very slightly so on the outermost, broadly so next the buff central feathers.

Chin and throat smoky buff, changing to rich pale rufous on the breast and flanks, each feather from the neck to the abdomen with a wide lanceolate white streak, edged with black and with more or less black and rufous along the shaft; abdomen and vent dull rufous buff, with a little white mottling; under tail coverts rich rufous, darker than the breast with white streaks centred and edged with black.

Colours of Soft Parts.—Irides brown or wood-brown; facial skin crimson or dull crimson; bill greenish or yellowish horny with darker culmen and black at base to end of nostrils; legs and feet greenish or slate horny, sometimes with a pinkish or fleshy tinge, never red or scarlet.

> "Iris dark amber; bill and legs dirty greenish white; skin "of face dark lake." (Wardlaw-Ramsay.)

Measurements.—The Museum series of about a dozen birds and fourteen others measured by me show far less variation in size than occurs in the males, a curious fact, which is confirmed by Hume's measurements.

Wing 8·0″ (203·2 mm.) to 9·2″ (234·7 mm.); but only one bird has a wing over 9·0″ (228·6 mm.); tail 8·5″ (215·9 mm.) to 10″ (254·0 mm.); tarsus 2·75″ (69·8 mm.) to 3·15″ (80·0 mm.); bill at front about 1·1″ (27·9 mm.) and from gape 1·4″ (35·5 mm.).

The average wing measurement of twenty-six females is 8·7″ (221·0 mm.).

"Weight 2 lbs. to 2·5 lbs." (Hume.)

The crest is considerably shorter than in the male, varying from 2·2″ (55·9 mm.) to 2·75″ (69·8 mm.), but is generally about 2·5″ (63·5 mm.).

Young Male.—Similar to the adult female.

Chick in Down.—Head above rufous, forehead and above eyes paler; a streak behind the eye extending over the ear coverts rich chestnut, much darker than the crown; above dull rufous brown, darkest along the back and paling on the sides; below dirty buffy white with very faint indications of a chestnut collar at the sides of the breast.

The variations in plumage in the male birds are not great, though in the extreme East and North of its range the markings become somewhat bolder on the upper surface and the extent of white on the sides of the breast and flanks somewhat more plentiful.

The females vary considerably; in many the white markings on the breast are streaks, and not V-shaped marks, the black edges to these marks are obsolete or absent, and the general colour is duller and darker. In some females also the white marks on the upper plumage commence on the nape, whilst in others the forehead and supercilia are freely marked with white. The proportion of black and chestnut on the outer tail feathers also varies extremely, as does the depth of the buff on the central ones.

Distribution.—The fact that on all the boundaries of its habitat this form grades through its various subspecies into *nycthemerus* and *horsfieldi* makes it extremely difficult to define its range with any exactitude. On the West the Irrawaddy undoubtedly divides it from *oatesi*, but at the same time one meets with numerous specimens in the extreme South and East of the Arrakan Yomas which approach typical *lineatus* very closely, and this magnificent river does not form as sharply cut a defining boundary as similar great rivers do with many other species of birds. To the North it extends up to Thaungyi, *i.e.*, 20° about, but West of the Sittang, where the Northern parts are more mountainous it appears only to be found as far North as Thaungoo, Thardoung and Kolidoo. In the higher hills of the Bree Country and again East of the Salwin in the Southern Shan States it is replaced by *sharpei*. West it crosses the Salwin South of Dargwin, and has been reported from Rahang on the Mewang River, but here, on the higher hills at all events, a bird more closely allied to *sharpei* is the common form. South of Muleyit it again appears to wander East across the Klang River, and stretches as far South as 14° and quite possibly much farther South than this, as Gyldenstolpe records a Silver Pheasant as far South as 12°.

As regards Siam, its range is very indefinite, and Gyldenstolpe's notes are invaluable; he records

> "Silver Pheasants belonging to this species were rather "common in the dense evergreen jungles which cover the hills, "dividing Tennasserim and Assam. In the neighbourhood of "Hat Sanuk (lat. N. 12°) especially, they were exceedingly "abundant. . . . . During my stay in North-Western "Siam I once caught a glimpse of a Silver Pheasant when I was "climbing up one of the steep hills at Doi Par Satring (lat. "N. 20°). . . . . It looked much more white than "*G. lineatus*, and was probably *G. nycthemerus ripponi*."

It will be seen from Count Gyldenstolpe's discoveries that the map given on page 62 of Vol. XXIII of the Society's Journal will require some alteration and a great extension of the green colour shewing the area inhabited by this pheasant.

A large amount of material is still required before we can work out the limits of the various geographical races of the Silver Pheasant, and Field Naturalists should remember that very careful minutiæ are necessary with the data tickets of specimens to enable the Museum Naturalist to formulate an outline of their different ranges. Thus when birds are got near places on rivers, it is no use merely to mark "shot near so and so", but it is imperative that we should know whether it has been got North, East, South or West of the place mentioned, and that the altitude also be given. In many cases we may get two forms, or even three, within shooting distance of one spot, yet a river may divide two races, whilst the other two may be divided by elevation alone, as appears to be the case in this instance between typical *lineatus* and the two subspecies *oatesi* and *sharpei*.

Nidification.—The breeding season of the Burmese Silver Pheasant commences in early March, and continues throughout April and May, but, as usual with this genus of Pheasant, nests and eggs may be found at odd times through a great part of the year. I have records from various sportsmen of eggs taken in February, March and April, and again in July, whilst Capt. Fielden obtained recently hatched young in August at Thayetmyo.

Hume also records eggs having been found in the middle of May. It seems to breed more often in Bamboo Jungles between 2,000 and 3,000 feet than in the heavier jungles and evergreen forests below the former height, or in the lighter deciduous and evergreen forests above the latter.

Its favourite breeding haunts are, perhaps, in the mixed bamboo and light deciduous forest which forms a feature of some of the Pegu Yomas, but the nest itself is nearly always placed in the bamboo patches and not in the forested parts. It is certainly found as high as 4,000 feet during the breeding seasons, and possibly a good deal higher, but, on the other hand, descends practically to the plains.

The nest is the usual rough collection of leaves and bamboo spates, deposited in some natural hollow and more or less protected by a clump of bamboo, bush or tree. Not infrequently it is placed well under a clump of bamboos in amongst the roots, so that it is completely hidden from the passer by, but at other times it may be found almost in the open. The bird is a close sitter, and will remain on her nest until an intruder is very close, she then, however, sneaks away so quietly and stealthily that it is very easy to overlook her.

The number of eggs laid appears to vary between 5 and 10, whilst 6 or 7 are the number most often found in acomplete clutch. The statements of natives quoted by Hume, to the effect that these Pheasants sometimes lay 14 or 15 eggs appear to be without any foundation.

The eggs are typical *Gennæus* eggs, that is to say like small eggs of a domestic fowl. Hume thus describes them :

> " All the eggs we have obtained are of the usual hen's egg " shape ; they are, of course, unspotted, and vary from a pale " yellowish to a warm pinkish café-au-lait colour. The shell, " though fine, is very full of pores, and these with some eggs " being filled with whitish chalky substance, give them the " effect of being stippled all over with white specks. None " of the eggs that I have seen have had any very perceptible " gloss, and as a rule, they seem to be, for game birds of this " class, very dull eggs."
>
> " The eggs vary from 1·81 to 2·03 in length, and from 1·4 " to 1·52 in width, but the average of nearly 30 eggs is 1·97 " by 1·46."

The few eggs I have seen including some of those described by Hume which are now in the British Museum, agree well with the above description, but the eggs strike one as being singularly level in colouration. All are a pale stone buff, varying very little in depth of colouring, and I have seen none which would really come under Hume's description of " warm café-au-lait." A few have a tinge of this colour and one pretty clutch of 6, given to me by Mr. Wickham, is quite a bright, though pale, pinkish buff.

The texture is fine and close with a faint surface gloss in fresh eggs, and the shell is very stout and compact. My series, a poor one combined with Hume's and others gives a much smaller average size, 1·86″ × 1·42″ (47·3 × 36·1 mm.), than that recorded above.

Oates says that :

> " The chickens, as soon as they are hatched, are very strong " on their legs and run with great speed. I was fortunate " enough to capture portions of four broods. It is astonishing

"in what a short time the little birds make themselves invisi-"ble. It is difficult to secure more than two birds out of one "batch. It is a case of pouncing on them at once or losing "them. The mother is a great coward, running away at the "slightest alarm, and thus contrasting very unfavourably "with the Jungle Fowl which keeps running round and round "the intruder with great anxiety until the young ones are in "safety."

General Habits.—The prevailing colouration of this Pheasant gives an excellent clue to its haunts and the general character of the country it inhabits. It is not to be found in the humid, evergreen forests beloved by the Black-Backed Kalij which finds concealment in their black depths as deep in shade as its own sombre plumage. Nor on the other hand must it be looked for in the high open grasslands frequented by the whiter forms of the Chinese Silver Pheasants whose pure whiteness find no great contrast in the sunlit grasses round them. As might be expected, the Burmese Silver Pheasant, with its dark silver upper plumage, will be found either in thin deciduous forest or in bamboo jungle. Here the glare of the tropical sunlight is filtered and broken by the intervening branches into thousands of specks or spots, bold bars and dashes of alternate light and shade of gleaming white, grey, or black. In such places with every passing breath of air the whole medly quivers and melts into an ill-defined greyness much like that on the back of the bird itself.

Davison, writing of the true *lineatus* from the neighbourhood of Moulmein, says:—

"They come continually into the open to feed about rice-"fields and clearings. They are shy, and usually run in "preference to flying when disturbed, except when put up by "a dog, when they immediately perch. Captain Bingham tells "me that on bright moonlight nights they constantly come out "into the clearings. Their food consists of grain, seeds of "various kinds, young leaves and grass, grubs and insects."

"They seem to prefer bamboo, or moderately thin tree "jungle to dense forest."

Oates' description does not agree well with the above in all respects, as he writes of it as a rather tame bird averse, however,

"to all cultivation, even to the extent of shunning the *yaks* "or hill gardens of the Karens, though these may be some "miles from the nearest *tay* or village."

He writes of this Pheasant's favourite haunts as follows:—

"It is rare or common just in proportion as the country is "level or mountainous. In the plains or undulating country "of Upper Pegu it will be met with in small numbers if the "ravines and nallas are sufficiently precipitous to suit its tastes;

> "but in these places, at best, only one or two will be shot in a "long morning's work. It is not till we get to the foot of the "hills that this Pheasant can be said to be common. Here the "nallas, with their pools of water and rocky beds, are particu-"larly favourable to it. As we mount higher it increases in "numbers to such an extent it is no difficult matter to knock "over half a dozen in a morning while marching, and that "without leaving the path."

During the breeding season the cock Pheasant of this species indulges in the same form of challenge to other cocks as that already described in regard to previous species, *viz.*, the drumming sound made by beating the wings against the sides of the body as the bird sits on some elevated position, such as an ant heap or some log or stump.

Oates says that the sound of the birds' wings may be very fairly imitated by holding a pocket handkerchief by the two opposite corners and then jerking one's arms apart, and he adds that he has himself on two occasions shot cock birds running excitedly towards the sound thus made.

Davison also refers to this method of challenge, which he calls buzzing, and remarks that the Burmans trap a great number of these Silver Pheasants by the aid of a decoy bird which is induced to "buz" and so call up other males around him, when they are caught in the noozes laid down for this purpose.

Like all Kalij Pheasants the Burmese Silver Pheasant is an inveterate skulker, and without a dog it is almost impossible to make them take to wing as they scuttle away to safety on foot with great speed. With a dog they are easy to flush, but even then when put up they, like the rest of their tribe, generally take to a tree or bamboo perch and then glide away from the opposite when the would-be shooter approaches.

The easiest way to get them where they are at all numerous is to wander along the edges of cultivation, or along some jungle path in the early mornings and evenings and trust to luck to coming across them and getting a snap-shot as they run for the nearest cover.

Of course, sometimes, the birds can be forced by beaters out of isolated patches of cover, and when such a proceeding is possible, fair sport may be had as the birds fly well when once started. Like most pheasants—indeed, like most game birds—they fly down-hill but always run up-hill when disturbed.

Although Oates found it very hard to rear the young, others have been more successful, and I am informed that they become very tame and domesticated, though if allowed to run loose, they generally disappear when the breeding season approaches.

They feed on both grain and other vegetable food and on insects. White ants, or Termites, and ordinary ants are a very favourite food and they also consume grasshoppers, beetles, worms and other similar forms. Shoots of many plants, all grain, bamboo and grass seeds, the different *Fici*, which are so plentiful in all Indian forests, yams, ginger and other ground roots all contribute at various times to their support.

They are said to be good for the table, but rather dry, though tender enough if eaten when killed or if hung for two or three days.

The males have a short harsh crow which, however, cannot often be used, for most writers make no reference to it, and Oates says that the only sound he has heard them utter is a low chuckle frequently uttered, both when the bird is alarmed and when it is going to roost.

GENNÆUS LINEATUS OATESI (Ogilvie-Grant).

Oates' Silver Pheasant.

Gennæus oatesi, Gilve-Grant, Cat. B. M., XXII., p. 306 (1893); id, Allen's Naturalist's Lib. Game-B., I., p. 276 (1896); Oates, Game-B., India, I., p. 348 (1898); Oates, Ibis, 1903, p. 103; Ghigi, Mem. Acad. Bologna (6), V., p. 141 (1908).

Gennæus lineatus oatesi, Stuart Baker, B. N. H. S. Jour., XXIII., p. 677 (1915).

Vernacular Names.—Yit (*Burmese*), Rak (*Arrakan*).

Description.—Adult Male.—Similar to *lineatus lineatus*, but with the vermiculations on the upper parts slightly bolder and better defined, though running across the feather as in that bird, and not following the contour as it does in the more Eastern and Northern forms. There is still a faint indication of the barring on the rump, though this differs in extent in different individuals. In a male from Thazi-Thaungi this barring is quite strongly developed, but in the type, which is merely labelled Arrakan, the rump bars are very faint, though still sufficiently plain to contrast with the back. The sides of the breast are well streaked with white.

Colours of the Soft Parts.—Apparently similar to those of the Burmese Silver Pheasant. "The legs are brown or dark flesh colour, and the skin of the face is crimson." (Oates.)

Measurements.—Wing 9·2″ (233·7 mm.); tail 11·6″ (294·6 mm.); tarsus 3·35″ (85·1 mm.); spur 1·0″ (25·4 mm.); bill from forehead 1·3″ (33·0 mm.) and from gape 1·4″ (36·0 mm.); crest 2·2″ (55·4 mm.).

I have only been able to obtain the measurements of three males.

Adult Female.—Differs from that of *horsfieldi* in having the whole tail chestnut brown or chestnut rufous, barred irregularly both above and below with brown. Of the three specimens in the British Museum Collection, two have the rectrices a dull pale chestnut brown, and the third has them a chestnut rufous. In each case the central rectrices are somewhat paler and more of a rufous buff than the others, but not sufficiently so to cause them to contrast with the other as they do in *horsfieldi* in similar cases. The type female has no pale markings on the back, but is redder than are most female *horsfieldi*, the two others are both marked with these central pale striæ, though to a less degree than in *lineatus*. All have pale buff striæ on the breast and flanks instead of white striæ as in *lineatus*.

Colours of Soft Parts.—Not recorded, but probably similar to those of *lineatus*.

Measurements.—Wing 8·1″ (205·7 mm.); tail 8·3″ (210·8 mm.); tarsus 2·9″ (73·6 mm.); bill at front 1·2″ (30·5 mm.) and from gape 1·4″ (36·0 mm.); crest 2·15″ (54·6 mm.).

Distribution.—The Arrakan Yomas from about 20·5° lat. in the North to the extreme South of Arrakan. To the East its boundary is the Irrawaddy River, which divides it from the area inhabited by the true *lineatus*.

The dividing line between Oates' Silver Pheasant and the Black-Backed Kalij is not easy to define, for wherever there are dense evergreen forests with low-lying well-watered valleys the latter bird is found encroaching South into the Arrakan Yomas; next these haunts of *horsfieldi*, we find a number of birds with an extraordinarily varying plumage, scattered here and there over a very narrow and broken area. These birds I previously accepted as a subspecies under the name of *cuvieri*. Now, however, I find that it is impossible to allocate to this supposed subspecies any definite range in which there is a consistent type of plumage obtainable, it is also impossible therefore to permit it to rank as a geographical race or subspecies and it must be suppressed.

The reason is merely that in the North-West the transition between *oatesi* and *horsfieldi* is abrupt because the climate and geographical factors also vary abruptly, and in consequence it has been impossible for a staple or permanent form to establish itself over any definite area intermediate between the two.

In the North-East of its range the change between *oatesi* and *williamsi* is very gradual, as are the geographical changes, but in the centre between the two there is some very dry country, too dry even for the grey forms of Silver Pheasant, so that we have a well-defined area into which no pheasant penetrates, except as a straggler, and on the outskirts of this dry area we have the two good subspecies *williamsi* North and *oatesi* South.

Nidification.—There is at present nothing on record concerning the breeding habits of Oates' Silver Pheasant beyond the fact that Capt. Fielden obtained young birds in August near Thayetmyo in Central East Arrakan.

The birds appear to breed principally in March, April and May.

and the few eggs in my collection have been taken in these months between the 20th March and the 10th May. The nests, as far as one knows at present, are always placed in bamboo forest or in the thick secondary growth which so quickly covers deserted cultivation patches in the same forest. It is quite possible that they have two broods in the year, though I do not think this is usual with birds of this genus.

Probably a full clutch of eggs is nominally 7 or 8 as in the other pheasants, but I have so far only records of 3 to 5 eggs, undoubtedly, with one exception, incomplete clutches.

They are exactly the same in every respect as the eggs of *lineatus lineatus*, and the average in size of 10 eggs 47·0 × 37·1 mm.

General Habits.—Capt. Fielden writes regarding Oates' Silver Pheasant, though he did not differentiate between the various forms of *lineatus*:—

> "This bird is tolerably common in the hills West of Thayet-"myo, but appears to be unknown to any but Burmese. It "seems to require rock and very steep hillsides, covered by long "grass for shelter, and flat alluvial soil, bare of grass and cover-"ed with brushwood and young trees, for feeding ground; in "fact, its feeding ground is exactly the same as that of the Black "Woodpecker, and I have several times lost a bird of each "species by being undecided which to fire at.
>
> "An old male is a most extraordinary looking bird. The "tail only is seen moving through the long grass, and I in-"variably thought at first that it was some new porcupine or "badger, or some animal. The note, too, adds to the deception. "It reminded me a little of the cries of young ferrets.
>
> "They run with great rapidity, but rise readily before a dog, "and would not be difficult shooting, but for the steepness of "the hillsides upon which they are found, and the nature of the "soil,—gravel just stuck together with the material that forms "the petrified wood so common there. This covered by grass "or dried bamboo leaves makes the footing so slippery that any "attempt to raise my gun hurriedly generally brought me to "my knees.
>
> "These birds feed a great deal on the young shoot of a kind "of Orchis, which rather resembles a large Roselle flower, and "its juicy leaves enable these pheasants to live for some time "far away from water; but in the middle of the hot weather "they are forced to retire from the Thayetmyo Hills by the "long grass being burnt. They return at the beginning of the "rains. They hatch in August."

To the above I can add but little, but most of my correspondents, who know these birds and their haunts, seem to consider them birds which *do* require to have water within reasonable reach for their morning and evening drink. Their flesh is said to be good, though rather dry, and perhaps inferior to that of the Jungle Fowl shot in the same jungles.

Mr. J. P. Cook, writing from the same place as Capt. Fielden, but in 1912, more than thirty years later, says that this pheasant is still very common there, and that in a comparatively short time he shot some thirty specimens, but could only preserve three, two males and one female. He found them frequenting either the same descriptions of cover as that described by Capt. Fielden or in bamboo covered slopes. They were most common between 1,000 and 2,000 feet, and did not appear to be birds of high elevation, though they were, on the other hand, sometimes found on the plain at the foot of the hills.

GENNÆUS LINEATUS SHARPEI (Oates).

Grant's Silver Pheasant.

Gennæus sharpei, Oates, Man. Game-B. I., p. 357 (1398); Oates, Ibis (1903), p. 101; Ghigi, Mem. Acad. Bologna (6), V., p. 140 (1908); C. S. Barton, Journal Nat. His. Soc., Siam, 1., p. 108 (1914); Stuart Baker, Jour. B.N.H.S., XXIII., p. 678 (1915); Guildenstolpe, Swedish Exped. Siam, p. 157 (1916).

Vernacular Names.—Yit (*Burmese*).

Description.—Adult Male.—Similar to the male of the Common Burmese Silver Pheasant, but the lines on the upper surface are well defined regular black and white lines following, for the most part, the contour of the feathers; even on the neck next the bare crimson face the markings could hardly be called vermiculations, whilst the lines on the sides of the neck lower down are quite distinct. At the same time the black bars and lines are not so far apart as they are in *rufipes* and, broadly speaking, *sharpei* may be said to be more black and white than *lineatus*, but less white in general appearance than *rufipes* and its other neighbours East and North of it.

Colours of Soft Parts.—

"Facial skin deep crimson; bill pale bluish horny; legs and "feet dark pinkish fleshy." (Davidson.)

"Legs reddish horny." (Cook.)

A male taken by Herbert's collectors at Korat is described by him as having the "facial skin red, irides brown, legs bright red."

Measurements of Type.—Total length 30·0" (Davidson). Wing 9·8" (249·0 mm.); tail 13·9" (353·0 mm.); tarsus 3·4" (86·3 mm.); spur 1·3" (33·0 mm.); bill from forehead 1·4" (35·5 mm.) and from gape 1·6" (40·6 mm.); "Weight 2·75 lbs." (Davidson).

A second male procured by P. C. Cook, Esq., had a wing of 9·9" (251·4 mm.) and a tail of 14·5" (348·3 mm.). The crest is short, 2·5" (63·5 mm.) or under.

Adult Female.—The type specimen obtained with the male can only be distinguished from the female of *lineatus* by the great breadth of the white marks on the lower surface of the body. Three females obtained at Muleyit and a fourth shot with the male obtained by Mr. P. C. Cook, all have the lower parts much darker than in any specimen I have ever seen of *lineatus*. The chestnut or rufous is in fact almost entirely absent on the lower plumage, and the feathers may be described as smoky black or dull dark brown with broad white centres not V-shaped.

It will probably be found that the lower plumage of the female ranges from a red, little darker than that of *lineatus* to the deep smoky brown of the Muleyit birds.

Colours of the Soft Parts.—"Facial skin deep red; irides brown, bill pale horny colour; legs, feet and claws pinkish brown." (Davidson).

Measurements.—"Expanse 29·75″; length 23·5″; weight 2·25 lbs." (Davidson).

The measurements of the five females referred to above are as follows:—Wing from 8·4″ (213·3 mm.) to 9·5″ (241·3 mm.); tail from 8·9″ (226·0 mm.) to 10·5″ (266·7 mm.); tarsus about 3·0″ (76·2 mm.); bill at front about 1·25″ (31·7 mm.) and from gape about 1·45″ (36·8 mm.); the crest is about 2·2″ (55·8 mm.) or rather less.

Distribution.—The distribution of this fine subspecies is not yet known with any certainty, and much more material is required before one can say where it meets *lineatus* on the West and South, *rufipes* on the West and North and *ripponi* on the North. Where it meets other forms to the East is still quite unknown. Its range would appear to run from Dargwin North a little way into the South Shan States, East over the Sittang and Mewang Rivers at least up to the Mennam River; South to Rareng and Muleyit and possibly in the higher hills as far as the 15° latitude.

In the North, Gyldenstolpe saw a bird at Doi-Par-Saken which he describes as being too white to be of this subspecies, and as nearer *ripponi* in its very white appearance. To the South on the 14° latitude at both M. Rat Bouri and M. Petcha Bouri the true *lineatus* is said to be common. It will probably be found to run up towards the Mekong River, but as yet the Silver Pheasants of this part are not known, and it is not possible to say where Grant's Pheasant will meet the forms known as *annamensis* and *beli* which are found in Annam and South-East Siam.

The furthest point to the South-East at which we *know* it to be found is the Korat Hills which lie roughly 15° latitude by about 101°—102·5° longitude. At this place Pheasants of this subspecies were obtained by Mr. E. G. Herbert's Dyak collectors, the males of which were fairly typical *sharpei*, but the females of which shewed a near approach to true *nycthemerus*.

Nidification.—Nothing recorded.

General Habits.—Nothing recorded.

Apparently this bird is not uncommon between 2,500 and 4,500 feet on the Hill Ranges within the limits of its habitat as described above, but it is such a skulker that it is still very little known, even by the few Europeans who have worked this part of the country. Messrs. E. G. Herbert, Williamson and others have done their best to obtain specimens, as also have Kloss and Robinson, but with little result. It would appear to be a form of *lineatus* replacing this bird in the higher, more open hills, especially on those hills which have more or less wide expanses of grass-land covering their crests and sides.

They stand captivity well, and Mr. Herbert has been successful in keeping adult birds for some time.

GENNÆUS NYCTHEMERUS NYCTHEMERUS.

The Chinese Silver Pheasant.

Phasianus nycthemerus, Linn. S. N., I., p. 272 (1768); Latham, Ind. Orni. II., p. 631 (1790).

Euplocomus nycthemerus, J. E. Gray, Ill., Ind. Zool., II., Pl. 38, Fig. 2 (1834); Blyth, Cat. Mus. As. Soc., p. 244 (1849); Gray, Hand-L., II., p. 260 (1870).

Gallophasis crawfurdii, Gray, Gen. Birds, III., p. 498 (1845).

Gallophasis nycthemerus, Gray, Gen. Birds, III., p. 498 (1845).

Euplocamus nycthemeruss, Gould, B. of A., VII., Pl. XVII. (1859); Elliot, Mon. Phas., II., Pl. 21 (1872); David and Ous., Oiseaux Chine, p. 416 (1877).

Gennæus nycthemerus, Ogilvie-Grant, Cat. Birds, B. M., XXII., p. 307 (1893); id., Hand-List Game-B., I., p. 277 (1899); Oates, Cat. Eggs B. M., I., p. 55 (1901); Ghigi, Mem. Acad. Bologna (6), V., p. 138 (1908); Ingram, Nov. Zool., XIX., p. 270 (1912); Stuart Baker, Journal B. N. H. S., XXIII., p. 679 (1915).

Vernacular Names.—Yit (*Burmese*), Wuri (*Kachin*).

Description—Adult Male.—Forehead, crown and crest black with a strong purple sheen; nape to end of upper tail coverts white with from 5 to 7 narrow wavy lines of black on each web following the outline of the feather, but completely dominated by the white ground; on the nape the lines are comparatively faint, and on the ear coverts and sides of the neck obsolete or entirely wanting. Whole visible portions of the wing like the back, but with only two to four lines on each web of the feathers, and these lines stronger and bolder than those on the back; tail with the two, three, or even four central pairs white, with a few irregular broken longitudinal lines on the bases of the outer webs, outermost tail feathers white with two or three bold black lines on either web; intermediate feathers grading from one to the other. Below from chin to end of under tail coverts velvety black with a deep purple-blue gloss.

Colours of Soft Parts.—Irides brown or red-brown; bill greenish or yellowish horny, the culmen and base darker; bare facial skin bright crimson red to almost vermilion red; legs brilliant coral red.

Measurements.—Wing from 9·8″ (248·9 mm.) to 10·8″ (274·3 mm.), the average being 10·3″ (261·6 mm.), tail from 21·6″ (548·6 mm.) to 27·8″ (706·1 mm.) in fully adult birds; tarsus from 3·75″ (95·2 mm.) to 4·0″ (101·6 mm.); bill at front 1·2″ (30·4 mm.), and from gape about 1·5″ (38·1 mm.). The crest varies between 3″ and 3·5″ (76·2 and 88·9 mm.), being generally well over 3·2″ (81·2 mm.). The spur is generally well developed and runs from about ·75″ (19·0 mm..) to 1·2″ (30·4 mm.), being generally well over the inch in full-grown birds.

Adult Female.—Whole of the upper plumage golden brown, the edge of each feather slighly darker, and with everywhere a powdering of dark brown, so minute as to be hardly visible without a close examination; terminal half of crest black, gradually grading into the brown of the crown. Two central pairs of tail feathers pale ashy buff, marked with fine broken bars of dark brown, lateral tail feathers black with straggling broken lines of white. Below, chin and upper throat pale ashy, changing to ashy brown on the lower throat and upper breast, the latter becoming paler and much mottled with brown spots and bars; lower breast still paler and with bolder bars and markings; remainder of lower plumage and flanks rather dingy white with bold, broad bars of dark brown; centre of belly and vent duller, and with fine bars of brown instead of broad ones.

Colours of Soft Parts.—Irides brown, golden brown or hazel; bill greenish or yellowish horny, pale at tip and dark at the base of the upper mandible; facial skin bright crimsom red, crimson or dull crimson; legs brilliant coral red.

Measurements.—Wing from 8·8″ (203·5 mm.) to 9·9″ (251·4 mm.), with an average of 9·2″ (233·6 mm.); tail from 9·8″ (248·9 mm.) to 12·3″ (312·4 mm.), generally about 11″ (279·4 mm.); tarsus about 3·5″ (88·9 mm.); bill at front about 1·1″ (27·9 mm.), and from gape about 1·4″ (35·5 mm.); the crest, which is rather meagre and thin, runs up to nearly 3″ (76·2 mm.), and is usually about 2·5″ (63·5 mm.).

Young Males and Females in First Plumage.—Similar to the above, but with the whole of the lower parts from throat to under tail coverts more or less uniform buffy brown, varying in depth from a pale, almost albescent buff (*see* B. M. specimen, No. 39·4.15.66.) to a deep umber, almost chocolate brown (*see* B. M. specimen No. 1907. 12. 31. 121.). In all specimens the shafts are paler than the webs, and shew up as faint or conspicuous streaks according to the depth of colouring adjoining.

The extent of mottling, vermiculations, or bars on breast, flanks and abdomen seems to vary in every individual; in some they are hardly perceptible, in others the centre of the breast and abdomen alone is faintly mottled or vermiculated, in others again the greater part of the lower plumage is thus marked, while in one or two the buff or brown is broken up everywhere with comparatively bold barrings or spots as well as with a sprinkling of white.

It would appear that these Pheasants take at least two years to acquire their full plumage, and that even the females go through the three moults before acquiring the beautiful black and white, or deep brown and white, under plumage.

Young Males in Second Plumage appear to resemble the females in adult plumage, and to go through the same variations and phases, though in some cases they moult direct from the first to the final plumage, and in others go through two moults to acquire this without ever assuming that of the adult female.

There are two young males in the B. M. Collection, one from Kuatun, and one from Canton, which appear to be changing from the mottled plumage into the adult, though it is evident that this moult would not have been complete for the feathers are parti-coloured, many shewing adult black bases and juvenile mottled tips. On the other hand a young male specimen of the subspecies *ripponi* shews that it is changing from the more uniform juvenile garb direct into the adult black and white.

At the same time some young birds in the possession of Mr. E. G. Herbert in Siam, which were brought in as young birds of the year, moulted in the same autumn into the complete male plumage without any intervening stage.

A very remarkable fact about Mr. E. G. Herbert's birds was that prior to moulting some of the feathers appeared to have assumed a partial adult colouration by the pigmentation of the dead feathers; these became marked with white or with black, the same in depth and tone as the feathers which came in their place.

Distribution.—"South China, Fokien, Chinkiang" (Grant). In my Review of this genus I wrote that "the Chinese Silver Pheasant appears to be found from latitude 28° to about latitude 22° on the Eastern watershed of the Salwin, but not in the lower lying country adjoining the river between latitude 22° and 24°." "Salwin" is, of course, a *lapsus calummi* for Mekong, West of which River within the latitudes given the Chinese Silver Pheasant is not found.

It is possible that when the range of habitat of this Pheasant has been more completly worked out, we shall have to extend the area into the Northern parts of Siam South and West of the Mekong to latitude 19·50° or even further South.

From the neighbourhood of Raheng we get a form of Silver

Pheasant which appears to be most closely allied to *sharpei* as do other specimens obtained by Mr. E. G. Herbert at Korat (lat. 15°, long. 102·5°), but these latter birds have brilliant red legs, and not fleshy grey or fleshy livid ones as in *sharpei*.

There still remains a great deal to be done in Siam and the adjoining countries before we can definitely lay down the areas occupied by the various subspecies of Gennæus.

General Habits.—The Chinese Silver Pheasant is normally an inhabitant of the highest and driest hills and plateaus above 6,000 feet and up to 9,000 feet or more. Also, as we should expect, it haunts the more open forests or country which is grass-covered and only intersected with forest by the lower lying valleys and ravines. It is doubtful whether this Pheasant ever really enters any part of the area covered by these articles, and it cannot be considered an Indian bird; at the same time the dividing line in appearance between true *nycthemerus* and its subspecies *ripponi* is so narrow that we may eventually find that the latter cannot stand, and, in this case, the bird will then have the status of an Indian, or rather, Burmese, Game-Bird.

GENNÆUS NYCTHEMERUS RIPPONI.

The Yunnan Silver Pheasant.

Gennæus ripponi, Sharpe, Bull, B. O. C., XIII., p. 29 (1902); Ghigi, Mem. Acad. Bologna (6), V., p. 139 (1908); Harington, Jour. B. N. H. S., XX., p. 377 (1910); Stuart Baker, ibid, XXIII., p. 684 (1915).
Gennæus jonesi, Oates, Ibis (1903), p. 97; Ghigi, *in loc. cit.* (1908).

Vernacular Names.—Yit (*Burmese*), Wuri (*Kachin*).

Description—Adult Male.—Only differs from true *nycthemerus* in having the black bars a trifle broader in comparison so that the upper parts at a short distance do not appear to be so pure a white. The sides of the neck are seldom so pure a white as they are in the Chinese bird, the tiny black vermiculations being more numerous and more pronounced. The tail also averages shorter.

Colours of the Soft Parts.—As in *nycthemerus*.

Measurements.—Wing 10·1″ (256·5 mm.) to 11·9″ (302·2 mm.); tail about 18·0″ (457·2 mm.) to nearly 25″ (635 mm.); tarsus 3·75″ (95·2 mm.) to 4·05″ (102·8 mm.); spur up to 1·25″ (32·7 mm.), and nearly always over an inch (25·4 mm.); crest from 3″ (76·2 mm.) to 4″ (101·6 mm.). The average length of wing of twelve adult males is 10·9″ (276·8 mm.), and of tail 22″ (558·8 mm.). The bill at front is about 1·2″ (30·4 mm.) and from gape about 1·5″ (38·1 mm.).

Adult Female.—To the extreme East of its range closely resembles the females of *nycthemerus*, but appears never to have so much white on the lower plumage and always to have a certain amount of rufous barring on the feathers like the hen of *rufipes*. To the East of its range the female more closely approaches *rufipes* and has still less of the white and more of the rufous barring below. The tail is on an average decidedly longer than that of the Ruby Mines Silver Pheasant, yet shorter than that of the Chinese bird. I have been able to examine very few females of this species, but the colours of the soft parts and the dimensions seem to agree with those of the Chinese Silver Pheasant.

Distribution.—This subspecies is confined to the inter Salwin-Mekong country from latitudes 21° to 25° certainly; possibly further North than the former and probably further South than the latter. Where this bird meets *sharpei* is at present unkrown, but there is probably a line where the two subspecies meet, and are not definable one from the other, on the ridges and hills which run East and West from Karen-nee to Doi-par-Sakem, or a little South of this in Siam.

Nidification.—Nothing known.

General Habits.—So far nothing has been recorded of the habits of this very doubtful subspecies, which will not, however, be found to differ in any respect from those of true *nycthemerus*. Like that bird it is found on hills covered either with a sea of grass, with light deciduous forest, or in places where these are mixed with and broken up by ravines and pockets of more dense jungle, often more or less evergreen in character.

It appears to prefer wide stretches of grass-land bordered by forest in which it can conceal itself in case of necessity, and especially does it haunt such as are rough and rugged and a good deal broken up with out-crops of rock. It is not, as far as is known at present, found below 5,000 feet elevation, and is found up to the highest altitudes of 9,000 feet or more; that is to say, this bird, a trifle darker in general tint than its Chinese relations, is also found at slightly lower elevations.

It would appear to be most common in Yunnan in the Trans-Salwin Hills at about 7,000 feet, where it is found in great numbers in the thin oak forests which are scattered about in small patches in the higher grass-lands, and where the only really dense vegetation is to be found in the wild tangles of growth on the borders of some of the streams and in the larger ravines.

Writing of such a country as this, a correspondent says *in epistola* :—

> "I'm afraid I cannot give you nearly as much information "about this beautiful bird as you may expect. In spite of its "being found generally in grass rather than in heavy trees or "bush cover, it is not an easy bird to find, and still less easy

"to bring to bag when once found. One imagines that such a "magnificent bird must be extremely conspicuous wherever "found, but such is by no means the case, and I have more than "once stared at a motionless bird some seconds before I could "make it out. The stunted and thinly foliaged oakes which "are scattered about at some distance from each other give such "a queer dappling of light and shade under the blazing Indian "sun that the outline of even glaring white objects cannot be "made out at once, and the broken black and white of the "Pheasants' back assimilates well with the waving grass and the "shivering broken shadows of the oak-leaves. Every breath "of wind which stirs grass and leaves alters your view, and it "is not until the bird rushes headlong away in the open or "skulks, head and tail down like some wild beast, into the "nearest raspberry tangle that you grasp the fact that you "have let a pheasant get away.

"Of course, once they are on the wing they can be seen and "heard from a great distance, but even under these circum-"stances I have been sometimes so struck with their beauty "that I have failed to fire until too late.

"One of my first encounters with these birds was when "working over the crest of a grass ridge with my sepoys, we "suddenly put up a covey of full-grown birds, and I was so "fully occupied in watching these streaks of silver loveliness "that I omitted to fire at all, and the whole lot—I think there "were 7 or 8—disappeared, unharmed down the hill into a "ravine with tree and dense undergrowth.

"Often we used to hear these Pheasants moving in front of "us as our scouts worked through the grass on either side of "our track the main body of our men were following, but we "very seldom put them up within sight. When we were "working up-hill they continued to run ahead of us until they "had crossed the ridge or crest of the hill to our front, and "then, when out of sight, they took to wing with much fluster "and noise.

"We noticed they always ran up-hill and flew down, and "always seemed to make for the highest point in the vicinity "before taking to flight.

"As on the occasion of which I just wrote we several times "came on coveys of full-grown cock birds without a single "hen anywhere near that we could see; it may have been that "the hens had skulked away on foot, but I think not, for "the sound of the running birds could be followed very clearly "when the grass and fallen leaves were dry and rustly.

"They crowed much like the common English Pheasant, "but a shorter. deeper sound. I never *saw* them crowing.

"but more than once put up cock birds from spots where I "had heard a vigorous crowing and flapping of wings going "on the moment before.

"They are not bad eating, but not nearly so tasty as our "home birds, but then they had not the advantages of hang-"ing, sauces, &c., except the one sauce, 'hunger.' The flesh "was very white, rather dry and, of the old birds, horribly tough. "One or two hens we shot and ate were much nicer than the "cocks.

"We never found their nests, eggs or young, but it might "not have been the right season for them."

GENNÆUS NYCTHEMERUS RUFIPES.

The Ruby Mines Silver Pheasant.

Gennæus rufipes, Oates, Man. Game-B., I., p. 362 (1898); id. Ibis (1903), p. 97; Ghigi, Mem. Acad. Bologna (6), V., p. 139 (1908).

Gennæus atlayi, Oates, Ann. and Mag. Nat. His. (8), V., p. 162 (1910).

Gennæus granti, Oates, Ann. and Mag. Nat. His. (8), V., p. 163 (1910).

Gennæus assimilis, Oates, Jour. B. N. H. S., XVI., p. 114 (1904); Oates, Ann. and Mag. Nat. His. (7), XIV., p. 286 (1904); Ghigi, Mem. Acad. Bologna (6), V., p. 141 (1908).

Gennæus elegans.

Gennæus affinis, Oates, Ann. and Mag. Nat. His. (7), XI., p. 231 (1903); Ghigi, Mem. Acad. Bologna (6), V., p. 143 (1908).

Gennæus nycthemerus rufipes, Stuart Baker, Jour. B. N. H. S., XXIII., p. 680 (1915).

Kalij Pheasants, Finn. and Nisbett, Jour. B.N.H.S., XIII., p. 521.

Vernacular Names.—Yit (*Burmese*), Wuri (*Kachin*).

Description—Adult Male.—Similar to *G. n. ripponi*, but still darker, the black lines and bars on the upper plumage being broader and more numerous, especially on the tail. The sides of the neck are less pure white, and as a rule are profusely vermiculated all over with fine, wavy bars of black. The tail is on an average much shorter than in *ripponi* and *nycthemerus*.

Colours of Soft Parts.—As in *nycthemerus*.

Measurements.—Wing from 9·7″ (246·5 mm.) to 11·0″ (279·4 mm.) with an average for twenty birds of 10·3″ (261·6 mm.); tail from 16·0″ (406·4 mm.) to 20·8″ (528·3 mm.), nearly always below 19·0″ (482·6 mm.); tarsus 3·45″ (87·5 mm.) to 3·85″ (97·7 mm.); bill at front about 1·2″ (31·0 mm.), and from gape 1·4″ (35·5 mm.); spurs nearly always under 1″ (25·4 mm.), and crest from 2·7″ (68·5 mm.) to 3·5″ (88·9 mm.), and averaging under 3″ (76·2 mm.).

Female.—General colour above rich olive brown, crest darker and tail very richly barred and mottled with deep chestnut and blackish brown, the outer tail feathers darker than the central ones. Under parts rufous brown to rich blackish brown, the feathers marked with bold concentric bars of rich fulvous, these bars following the contour of the feathers, and not in longitudinal striæ as in *lineatus*.

Colours of the Soft Parts. As in *nycthemerus*.

Measurements.—Wing 9″ (228·6 mm.) to 10·1″ (256·5 mm.) with an average for twenty-one birds of 9·6″ (243·8 mm.); tail from 9·2″ (233·6 mm.) to 12·0″ (304·8 mm.), with an average of about 10·8″ (274·3 mm.); tarsus about 3·3″ (83·8 mm.); bill at front about 1·1″ (27·9 mm.) and from gape about 1·3″ (33 mm.); crest about 2·0″ (50·8 mm.).

In adult females there is generally an indication of a spur shown by a knob which sometimes protrudes from the tarsus as much as ·15′ (3·7 mm.).

"*Weights.*—The average weight of the male is 3 lbs., and that of the female 2½ lbs. The above averages have been obtained by weighing some twenty specimens." (Nisbett.)

Distribution.—Roughly speaking, the range of this bird is bounded by the Irrawaddy and Salwin Rivers on the West and East respectively, on the North by latitude 27° and South by latitude 21°. It must, however, be remembered that *Gennæus horsfieldi horsfieldi* wanders down the Irrawaddy over the greater part of this area on the banks of the river and lowest hills, and that between the habitat of the two birds there is a no-man's land which is occupied not only by birds which are in a geographic (or climatic) transitional stage, but by a very great number of pheasants which are hybrids, the result of direct crossing between true *horsfieldi* and *n. rufipes*.

The article by Mr. Finn and Capt. Nisbett in this Journal XIII., p. 521, is of the greatest interest, and it is remarkable that this combination of acute observers should have got so much nearer the truth in regard to the subspecies and species of *Gennæus* than did Oates with nearly ten times the material to work on. Capt. Nisbett remarks:—

> "The lower in altitude and the nearer the Irrawaddy one "finds them, the more they partake of the Black-Breasted "Kalij in character; and the higher one gets towards the "Chinese frontier, the more they partake of the appearance of "the Silver Pheasant."

Mr. Finn adds to this:

> "There can be no doubt that the very interesting series of "forms of *Gennæus* forwarded by Capt. Nisbett and described "above, are hybrids of various grades between the common "Black, or Black-Breasted Kalij (*Gennæus horsfieldi*) and

"Crawford's or Anderson's Silver Pheasant with which I unite
"Mr. Oates' *G. rufipes* from the Ruby Mines."

Nidification.—Nothing recorded. I am told by my correspondents that March and April are the two principal breeding months for this Pheasant, though none of them have so far been successful in taking eggs or chicks.

"It is probable that they will be found to breed in the two months mentioned and in May as well.

General Habits.—Captain Nisbett writes as follows:—

> "These birds are found at an altitude between 3,000 and "5.000 feet. They are generally found in parties of 3 to 7, "though the males often wander about by themselves. They "generally keep in the nullahs near the water during the heat "of the day, and in the early mornings and towards evenings "feed along the hillsides and on high ground, being especially "fond of long flattish spurs or knolls covered with open ever-"green forest. They are intensely shy, and one rarely has an "opportunity of seeing them, as they make off very quickly on "hearing anyone coming, and then rarely take to flight, unless "run down by dogs, when they fly up into the trees. They "are confirmed runners, and it is often hard to make them "take flight even with dogs. Their food consists entirely of "jungle seeds, insects and acorns. My usual way of obtaining "them was to walk very quickly along a jungle path until I "heard the sound of their scratching up the dry leaves in "search of food. I would then send a cooli, who always "accompanied me, to take a circuit in the jungle and get "round them; and on his advancing towards them, they "nearly always came within shot. This sounds like poaching, "but it is the only way of getting them: shooting them in a "fair way is impossible. On my first acquaintance with "them, it took me over a fortnight to get a single specimen, "though I met them every day.
>
> "The breeding season begins about April, when the cocks "can be heard challenging one another in the early morning. "When breeding, they appear to leave their usual haunts "in the open jungle, and disappear altogether, probably in "the thick undergrowth. Since the end of April I have "hardly come across a bird, though I constantly met them "before.
>
> "I have not been successful in obtaining any eggs, though "I have asked Kachins to try and get me some."

All that can be added at present to the above is that after April the birds probably go into the still higher hills to breed, which would account for Capt. Nisbett never putting the birds up, and for the Kachins failing to obtain eggs.

Genus—*PHASIANUS.*

True Pheasants.

The True Pheasants form a genus of which the Common and Ringed Pheasants are well-known examples. The tail which is of 16 or 18 feathers, is longer than the wing in both sexes, and in the male often reaches a very great length; it is strongly graduated, the outermost pairs being frequently much shorter than the upper tail coverts. There is no crest, but usually two short thick tufts on either side of the crown behind the eye, which are, however, very small in some species. The males are brilliantly coloured with both ordinary and metallic colours, whilst the females are plain brown birds more or less mottled with varying amounts of buff, rufous, black and white.

The wings are rounded with a small first primary intermediate in length between the 7th and 10th and the tarsi and feet are strong and well-formed for running, and are furnished with a spur in the male which is rudimentary or absent in the female.

The space round the eye is bare in the males, and in some species is developed into wattles, in the female the eye area is feathered or bare in a less degree than in the male.

There are two species of true Pheasants found within our limits, *Phasianus humiæ humiæ* and *Phasianus elegans*, and a second subspecies of the former *P. h. burmannicus.* These birds have often been referred to the genus *Callophasis*, a genus created by Elliott for *Callophasis elliotti.*—I do not, however, see sufficient reason for dividing the two genera.

Elliott gave his reasons for dividing them as follows:—

(1) In the genus *Callophasis* as represented by *elliotti* the bare skin of the face never developes into the heavy wattles found in all males of true *Phasianus*.

(2) The feathers of the lower rump

> "are rounded and proceed in regular rotation down the back "and form an abrupt, distinct line just above the upper tail "coverts, leaving them entirely exposed" . . . In all "true pheasants these are long, loose, split and of a hairy-like "texture, very dense and almost, if not entirely, conceal "the upper tail coverts."

(3) The spur is in shape and character nearer to *Gennæus* (*Euplocomus*) than to *Phasianus*.

Of the three reasons given (1) is only a matter of degree, (2) is to some extent a matter of degree, and (3) is not correct for the spur is actually much more like that of *Phasianus* than the *Galline* spur of *Gennæus.*

As regards the female, Elliott observes that it

> "exhibits to an even greater degree than the male, characters "not found in any species of Pheasant belonging to existing "recognised genera" (? species) "and in her relation to "him, differs in a more marked manner than is to be witnessed "among the females of any of the species of the genus "Phasianus."

The characters to which he refers are (1) the naked space round the eye, (2) the comparatively short tail, and (3) the indication of a spur.

Here again, (1) is the only point which needs to be dwelt upon, (2) is entirely a matter of degree, and (3) is incorrect, for there is an indication of a spur in the females of nearly all the Pheasants, whilst actual spurs are by no means uncommon.

The differentiation between *Callophasis* and *Phasianus* rests therefore entirely on the supposed structural differences in the rump feathers of the male and the bare orbital skin of the female. Under these circumstances, as I have said above, I retain all the species under the one title of *Phasianus*.

KEY TO SPECIES AND SUBSPECIES.

A. 16 tail feathers, cross bars on central tail feathers an inch or more apart. Crown green in males.
    a. Rump steel blue and white in equal portions ... ... *P. h. humiæ.*
    b. Rump black and white, the latter predominating ... ... *P. h. burmannicus.*
B. 18 tail feathers, cross bars under one inch apart in both sexes ... ... *P. elegans.*

PHASIANUS HUMIÆ HUMIÆ (Hume).

Mrs. Hume's Pheasant.

Callophasis humiæ, Hume, Str. Feath., IX., p. 461 (1881); id, ibid, XI., p. 302 (1888).

Phasianus humiæ, Godwin-Aus. P. Z. S. (1881), p. 715, Pl. LI.; Ogilvie-Grant, Cat. Birds B. M., XXII., p. 335 (1893) (part); Blanford, Fauna B.I., IV., pp. 80, 486 (1898) (part); Finn., Jour. A. S. Beng. (2), LXVI, p. 523 (1897) (part); Finn and Turner, ibid, LXIX., p. 144 (1900); Venning, Jour. B. N. H. S., XXI., p. 632 (1912); J. P. Cook, ibid, XXII., p. 270 (1913); Mackenzie and Hopwood, ibid, XXV., p. 91 (1907).

Calophasis humiæ, Ogilvie-Grant, Monograph Game-B., II., p. 42 (1897) (part); Sharpe, Hand-L., I., p. 38 (1899); Finn, ibis (1898), p. 311 (part); Oates, Man. Game-B., I., p. 304 (1898). Finn, Indian Sporting-B., p. 201 (1915).

Vernacular Names.—Yit (*Burmese*), Wuri (*Kachin*); Loe-ninkoi (*Manipuri*).

Description—Adult Male.—Crown brown, tinged with olive, the feathers next the bill and over the eye next the bare orbital skin dark brown, faintly glossed with green, chin and upper throat black; neck, upper breast and upper back deep velvet-black with broad edges of deep steel blue, the black centres concealed, or merely shewing on the posterior parts as half hidden round spots; the blue of the upper back sometimes descends on to the centre back, almost to the lower back, and in all cases the change between the two colours is gradual, patches of metallic blue occurring even on the lower back; interscapulars and back with flame-coloured copper instead of green edges; lower back and rump steel blue, much paler in tint than the back, and each feather with white edges and a white bar bordered above and below with black; upper tail coverts grey, faintly vermiculated with white and with an obsolete broken black bar across the centre; tail similarly vermiculated grey with bars of black, more or less mottled with chestnut on the central pair of feathers, and with a broad sub-terminal bar on the four outer pairs, increasing in width towards the outermost; two or three pairs of these are also tipped with mottled white. Lesser wing coverts and median wing coverts like the back, the former with a broad band of white, narrowly edged with steel blue and with bases of glossy blue-black, and the latter with a broad bar of black glossed with the same steel blue as the rump; greater coverts deep chestnut, those next the quills with broad white edges and blue-black sub-edges, forming a third double bar across the closed wing; primaries brown, edged chestnut, secondaries entirely chestnut on the exposed portions except the innermost, which have white tips with a narrow sub-terminal bar of black. Lower breast like the upper back, gradually merging into deep bright chestnut on the flanks and abdomen; thighs and centre of abdomen about vent mottled brown and chestnut; under tail coverts black with a faint blue-green gloss.

> "Male.—Length 33·0 inches; expanse 26·0; tail (of sixteen feathers) from vent 21; wing 8·6; tarsus 2·75; bill "from gape 1·3. Weight 2 lbs. 6 ozs. The legs, feet, claws "and spurs (the latter 0·85 length) all a pale delicate drab "brown; the facial skin an intense crimson; irides orange; "bill greenish horny, dusky on cere and base of upper mandible, and pale yellowish horny towards the tip of both "mandibles." (Hume.)

Measurements.—The small series I have been able to examine or obtain measurements of, *viz.*, 6 in the British Museum, 2 at Tring, and 3 in the Museum of the Natural History Society of Bombay, have measurements as follows:—Wing from 8·1″ (205·7 mm.) to 8·8″ (223·5 mm.); tail from 15·8″ (401·3 mm.) (a bird in very poor condition) to 21·5″ (534·6 mm.); tarsus 2·3″ (58·4 mm.) to 2·6″ (66·0 mm.); bill at front about 1·1″ (27·9 mm.), and from gape about 1·3″ (33·0 mm.); spur from ·33″ (8·3 mm.) to ·7″ (17·7 mm.), generally under the half inch (12·7 mm.). The average length of wing is 8·5″ (215·0 mm.).

Young Males.—In otherwise fully adult plumage, have the wing quills *mottled* brown and dull chestnut, but *not barred* like the females.

Adult Female.—Upper parts of the head reddish brown, the feathers of the crown with more or less well-defined black centres; sides of the head, lores, ear coverts and chin dull fulvous, sparsely spotted posteriorly with black; neck sandy brown above obsoletely barred with blackish and more boldly so on the sides; upper back and scapulars the same, but with bold velvety black edges and bars and white arrow-shaped mark in the centre of each feather; lower back rump and upper tail coverts mottled sandy-brown and black with indefinite black centres to the feathers, more pronounced on the rump where there are also some white marks, and on the upper tail coverts. Central tail feathers like the tail coverts with ill-defined mottled bars of dark brown; outer tail feathers chestnut with black bars and broad white tips. Below, the breast is pale sandy or greyish brown with a few black spots; lower breast, flanks and greater thigh coverts sandy rufous, barred with very pale grey; thigh coverts a darker sandy brown, and the vent and centre of the abdomen duller and paler than the flanks; under tail coverts mottled brown, white and sandy, the longest chestnut with black, bars and broad white tips. Visible plumage of the wings mottled grey, brown and sandy rufous with bold markings of black, and with whitish edges to the median and greater coverts, which form narrow and faint white bars across the wing; primaries brown, mottled with rufous and with broad pale buff bars on the outer webs.

Measurements.—The only female I have been able to measure has a wing of 7·8″ (198·1 mm.); tail 7·5″ (190·5 mm.), and tarsus of 2·4″ (60·9 mm.); the bill at front is about 1·0″ (25·4 mm.), and from the gape 1·2″ (30·5 mm.). It should be noted that Godwin-Austen gives the length of his specimen's wing in the flesh as 8·25″, and the tail as 7·0″ only.

Colours of Soft Parts.—The only note I can find on this point is in Godwin-Austen's description, in which he says:

" A nude red patch surrounding the eye."

Distribution.—Until very recently all that was known of this bird's habitat was Hume's description in Stray Feathers, and Godwin-Austen's in the Zoological Society's Proceedings.

The former recorded them as being found in the Kamhow district of South Manipur, Eastern Looshai and North-West Independent Burma, while the latter obtained specimens, as had Dr. Watts, in North-East Manipur close to the Naga Hills.

Latterly they have been repeatedly shot on the Chin Hills as far South as Falam and Fort White, whilst Venning reports them as not uncommon still further South at Haka, where he saw flocks of as many as ten birds together. Again East and North-East of Manipur on the hills bordering the Chindwin and Oyu Rivers, it has been seen and shot, and it certainly extends as far North-East as the Patkoi Hills, as I have seen its feathers on the baskets of the Nagas from this district. At present there is nothing to show what is the boundary between *humiæ* and *burmannicus,* and this may prove to be either the Chindwin or the Irrawaddy, as, so far, no birds of this genus have been found in the inter-land of these two rivers. Probably, however, considering the distribution of *humiæ* in the N. E. Naga and Patkoi Hills, the latter river will be found to be the Western limits of *P. h. burmannicus.*

Nidification.—As far as I know, the only collectors who have hitherto succeeded in finding the nest and eggs of this most beautiful bird are Messrs. Wickham, Hopwood and Mackenzie, to whom I am indebted for specimens of the eggs and many valuable notes.

The two latter gentlemen, when touring in the North Chin Hills, had a clutch of 8 eggs brought in to them in the end of April 1914 by the Chins, said to be those of Mrs. Hume's Pheasant; unfortunately they were on the verge of hatching, and it was only possible to save 4 eggs out of the clutch. The eggs were, however, not such as had been expected, so that it was with the greatest delight the same two collectors had the good luck to themselves to take a second nest and see the parent bird within a few days of receiving the first. This nest, which was found on the 1st of May, contained only 7 eggs.

In the following year, near the same spot and on the same date, Mr. Mackenzie obtained another nest with 10 eggs, whilst on the 20th April and the 1st May two other clutches were brought to him by Chins, containing respectively 6 and 7 eggs. In neither of these two instances were the parent birds trapped, though the Chins produced some feathers to support their story; the eggs are, however, exactly similar to those taken personally by Mr. Mackenzie, and there does not seem to be any reason to doubt their authenticity.

All these eggs were taken from a ridge above and to the West of Haingyan, near Hankin, at an elevation of some 7,000 feet.

Mr. Mackenzie (*in loc. cit.*) gives a brief note on the breeding of the Pheasant, but unfortunately tells us nothing about the nest or where it is placed. He writes:

> "Eggs, with a bird skin. The eggs were of the ordinary "*Phasianus* type: three clutches were obtained, all from about "6,500′. The bird seems to breed near the top of the main ridge."

The eggs are certainly not in the least like what I should have expected, being far more like small, fragile eggs of the Jungle-Fowl than those of the True Pheasants. At the same time, even if Mr. Mackenzie had not, as he informs me in a letter, on the one occasion seen the bird leave the nest, it would have been difficult to attribute them to any other bird than Mrs. Hume's Pheasant. The Jungle-Fowl does not breed at 7,000 feet in this part of Burmah, and the eggs are *much* too small for any of the forms of Silver or Kalij Pheasants which are to be found in the Chin Hills and, moreover, though superficially just like Jungle-Fowls' eggs, those I have seen are more finely grained, with a closer texture, slightly glossed, and with much thinner shells in proportion to their size.

Eggs very similar to those in my collection—which I owe to the generosity of the above-named gentleman—are four eggs laid by *P. elegans* in the Zoological Society's Gardens in Regent's Park, and which are now in the Natural History Museum. Both *Phasianus, scintillans* and *P. elliotti* also lay cream or stone-coloured eggs, so that there is really nothing extraordinary in Mrs. Hume's bird doing the same.

In shape they are broad ovals, but little compressed towards the smaller end, and do not appear to vary much, but one egg in Mr. Mackenzie's series is a comparatively long oval measuring 1·99″ × 1·31″ (50·5 × 33·2 mm.).

In length the 30 eggs of which I have measurements vary between 1·78″ and 2·03″ (45·2 and 52·8 mm.), and in breadth between 1·31″ and 1·48″ (33·2 and 37·6 mm.), the average of the same number being 1·88″ × 1·39″ (47·7 × 35·3 mm.).

These Pheasants would appear to be early breeders, for both the clutches obtained in the end of April were so hard set that they must have been laid in March, and, though it is hardly safe to generalise on such scanty material, the 15th March to the 15th May is probably the limit of their breeding season.

General Habits.—This beautiful Pheasant, according to reports made to Hume by his Kamhow collectors, is found

> "In dense hill forests at elevations of from 2,500 feet (the "height of the lower end of the Manipur Plain, or, as it is "mis-called, valley) to fully 5,000 feet. They prefer the "neighbourhood of streams, and are neither rare nor shy."

This description of their habitat is probably not correct. For fifteen years I lived in the North Cachar Hills next to Manipur, and yearly visited the Jhiri Valley, and worked it and the adjoining hills most exhaustively up to 5,000 and 6,000 feet, but never saw nor heard of this bird being found there. All my Manipuri collectors, also, assured me that the bird was not found until one got into the far higher country running from the Naga Hills round the far North and East of the Manipur Plain at elevations from 4,000 feet or more up to 9,000 or 10,000. The lowest point at which Godwin-Austen got it was on the Shiroifura peaks at between 7,000 and 9,000 feet; in the Eastern Chin Hills it is found between 4,000 and 7,000 feet, and at Haka at about 4,000 feet and upwards, whilst in the extreme North of the Chin Hills it is found from 6,000 to 9,000 feet.

It may, of course, wander down sometimes as low as 2,500 feet in the coldest part of the cold weather, but I think such occasions must be of the rarest.

Again it does not appear to be a denizen of the dense, tropical and more or less evergreen forests of the hills of the lower elevations, but to haunt the more open oak, pine and other forests and grass lands which are to be found from 4,000 feet upwards. Mr. J. P. Cook found it frequenting heavy patches of grass and dwarf date palm in more or less open grass land mixed with patches of forest and found that they had been feeding on acorns. Again, near Fort White one of my correspondents informs me that he always obtained these pheasants

> "in forest growing on very rocky, broken hillsides, where the "undergrowth was light, except for open patches of bracken "and grass, and the trees, for the most part, stunted and grow-"ing well apart from one another. If not in this kind of "forest, they were to be found in the open grass-land, feed-"ing in the more open land, and lying up during the hotter "hours in the denser patches."

Finn, who was the first writer to draw attention to the difference between Mrs. Hume's Barred-Back Pheasant and the Eastern Burmese form, quotes at some length an interesting letter from a Mr. Turner.

> "I had left my camp, which was pitched some six miles "from Fort White, on the evening of 6th March, to go after "some Hill Partridges, which one of my men had seen just "below my camp; not seeing any signs of them, I walked "on for about a mile, and was returning along the road "(the Fort White-Kalemyo Road) when, glancing down the "*khud*, I saw something grey disappearing in the long grass "just below me. I immediately started to go after it, when "I saw what appeared to me to be a light blue streak just dis-"appearing. I immediately fired, but it was with faint hope "I walked up to the spot, as not only did I think the bird "had disappeared before I shot, but I had just at the moment "of shooting, slipped. I was therefore very much delighted "when I saw the blue streak tumbling down the *khud* below "me. I immediately went after and secured him; as I was "descending the original grey bird, which was evidently the "female, got up and flew a short distance. I walked her up,

"and my dog again put her up; unfortunately, owing to "the thick jungle, I was unable to get a shot. Walking "on, however, I again put up another, whether a cock or hen, "I could not say, as it was already dark. I fired, but the "bird flew away, and although I believe it dropped, I "could not find it. These birds, when I saw them, were "feeding amongst the dead leaves which littered the ground.

"The next evening I tried the upper side of the road, and "put several (four at least) of the same birds out of the long "grass on a steep hillside. I only managed to get one long "shot which was not successful. I again tried the next morning, and was successful in bagging another; my dog put it up "on our right, and flying very low through the bushes, it "crossed just in front of me. Unfortunately, the bird was not "well skinned, and I had to throw it away.

"The specimen that I have retained is a full-grown cock; the "other one was a young cock without the long tail, the plumage "was otherwise identical with that of the other bird. The "hill on which I obtained these specimens was between 4,000 "and 5,000 feet high, being one of the spurs of the Chin Hills "running down into the Kale Valley, and the birds were "close to the Fort-Kalemyo Fort White Road, just about at "milestone 20. The latitude is approximately 23° and the "longitude approximately 96°."

Mr. Cook in a letter to me writes :

"*P. humiæ* I often saw and shot. The birds were generally "to be found in somewhat open jungle, where the trees are "principally oaks and similar species, and where one finds an "undergrowth and open spaces of long grass, or long grass and "bracken mixed. Near Minkin I found them in steep grass "slopes, and here they were by no means uncommon, and "associated in small flocks or family parties. On one occasion "I flushed no less than eight or ten birds from an ant-hill "overgrown with grass and crowned with a clump of dwarf "dates, upon the fruit of which I think the Pheasants were "feeding. On another occasion I saw a couple of hens with "a cock at Pine-Tree Camp in similar jungle and at about the "same elevation (7,000 feet).

"As far as my experience goes they do not fly very far "when first flushed, and as a rule they fly low down, seldom, "if ever, rising above the tops of the trees ; nor does their "flight strike one as being at all fast, and, indeed, compared "with the English Pheasant, it seems very much slower. "They are not hard birds to flush, especially the first time, "but as I have nearly always had a dog out with me when "after these birds, I cannot speak with much authority on "this point. When alighting after the first flight, they often "run considerable distances, but at others one may put a "bird up time after time from almost the exact spot at which "he drops.

"They are such beautiful birds that their very beauty has "sometimes saved their lives when I have really wanted them "very badly; their skins as specimens and their flesh for the "pot. To see half a dozen cock birds rise almost at one's "feet and then scatter in all directions, the wonderful blue and "white feathers of their rumps shewing up like flags against "the rest of the brilliant plumage, is a most extraordinary "sight, and I have found the blaze of colour so gorgeous and "attractive that I have sometimes been arrested in the very "act of raising my gun to fire, and have instead stood to "watch them and enjoy the sight.

"I think wherever I have found this bird there have been "outcrops of rock here and there in the grass they frequent. "In some cases these outcrops are scattered and few, but in "some cases very thick and plentiful, so that the patches of "grass form little roads in between them.

"The only sound I have heard them make, and which I "can with certainty attribute to them is a low grunting call, "exactly the same as that made by *Phasianus burmannicus*, a "bird I knew well in the South-East of these Hills."

The discovery of this beautiful Pheasant by Hume in 79 was always considered by him to be one of the, if not the, most important and interesting of his numerous discoveries. His attention in the first place was drawn to some feathers in the head-dress of a Manipuri Official sent to assist him in getting about in Manipur, which he at once saw belonged to a Pheasant unknown to him. These he was told were feathers from a bird called Loe-nin-Koi which occurred in the extreme South of the Manipur territory and in the Eastern Lushai country. It was weeks, however, before he succeeded in going with a small force of Manipuris into the Kamhow district, and even then it was only with the greatest difficulty that some Kamhow refugees were induced by a mixture of threats and promises to secure for him two specimens, one of which was alive.

Of the living specimen Hume wrote:

"The live bird, though a full-grown cock, became perfectly "tame in a few days, and a great favourite in the camp. It "would eat bread, boiled rice, winged white-ants, moths, "taking them gingerly out of our hands."

Unfortunately this bird was eventually killed in a fire, so never reached its destination, the London Zoological Gardens.

PHASIANUS HUMIÆ BURMANNICUS (Oates).

The Burmese Barred-Back Pheasant.

Calophasis burmannicus, Oates, Ibis, 1898, p. 124; Sharpe, Hand-List, B., IV., p. 38 (1899); Finn, Ibis, 1898, p. 311 (part); Harington, Jour. B.N.H.S., XX., p. 1010 (1911); Oates, Man. Game-B., I., p. 308 (1898): Finn, In. Sporting B., p. 301 (1915).

Phasianus humiæ, W. L. Sclater (nec Hume), Ibis, 1891, p. 152 (part); Oates, Jour. B.N.H.S., X., p. 112 (1895); Ogilvie-Grant, Cat. B. B. M., XXII., p. 335 (1893) (part); id, Mon. Game B., II., p. 42 (1897) (part). Blanford, Faun B. I., IV., pp. 80, 486 (1898) (part); Finn, Jour. A. S. B. (2), LXVI., p. 523 (1897) (part); id, ibid (2), LXIX., p. 144 (1900); Cook, Jour. B. N. H. S., XXI., p. 632 (1912); id, ibid, XXII., p. 270 (1913).

Vernacular Names.—Yit (*Burmese*), Wuri (*Kachin*).

Description—Adult Male.—Similar to *P. humiæ humiæ*, but with the steel blue of the upper parts confined to the extreme upper back, and much more sharply defined from the copper-coloured mantle; the rump is black and white instead of blue and white, and even when there is a certain amount of blue gloss, as is sometimes the case, this is of a deeper tint than it is in Mrs. Hume's Pheasant; the white fringes are also broader and more dominant than they are in that bird.

The colour of the tail bars, given by Oates as one of the distinguishing features, is not of much use. Generally there is more chestnut on those of *P. h. burmannicus*, but this is not invariably so, and in some birds there is no more than in the type of *humiæ*. Again, Oates' definition of the differences in the colour of the bases to the feathers of the lower white wing bar does not hold good. He says that in *humiæ* the concealed bases to these feathers are black, whereas in *burmannicus* they are "chestnut with a firm black bar." This is practically correct as far as the types of the two subspecies are concerned, though the bases of the innermost feathers are well-marked with chestnut in the wing of *humiæ*, but in other specimens this difference is not maintained.

In *burmannicus* the central black wing-bar is often mixed with maroon or copper colour, but this is not always so, and in one specimen in the British Museum series this black wing-bar is broader than in any specimen of *humiæ*, and is equally free from all admixture of maroon.

Measurements and Colours of Soft Parts.—The same as in *humiæ*. In the series of 16 males in the British Museum and at Tring the wing varies between 8·5″ (215 mm.) and 9·3″ (236·2 mm.), with an average of 8·85″ (224·9 mm.); the tails run up to 26·5″ (673·1 mm.), and average about 22″ (554·8 mm.), tarsus, spur and bill measure within the extremes given for *humiæ*.

Adult Female.—Similar to that of *humiæ*.

Measurements.—Wing from 7·7″ (195·8 mm.) to 8·3″ (210·8 mm.); tail 7·7″ (195·8 mm.) to 8·6″ (218·4 mm.); tarsus about 2·4″ (61·0 mm.), bill at front about 1″ (25·4 mm.) and gape 1·2″ (30·5 mm.).

Distribution.—Yunnan, Northern Shan States, and the greater part of the Southern Shan States. To the West it appears nowhere to cross the Irrawaddy, which River probably forms the dividing barrier between this and Mrs. Hume's Pheasant. To the East we do not yet know for certain how far it extends, but up to now there is no record of its having been seen or obtained East of the Salwin River. I have records of its having been obtained at Myitkyna, Sadon, N. E. of Nilamka, Mogok, Maymyo, Kalaw, Taungyi, Fort Stedman, and Loimai. South of this again, North of the Bree country, a Pheasant has been seen which will assuredly prove to be of this species, and almost equally certainly of the present subspecies, but no specimen has been actually secured.

Nidification.—There is at present absolutely nothing on record about the breeding of this beautiful Pheasant, but, with the care and industry with which our field-ornithologists are now working Burmah, the finding of the nests and eggs cannot be long delayed.

General Habits.—Like its cousin, Mrs. Hume's Pheasant, the Burmese Barred-Back Pheasant frequents the mountainous regions of Eastern Burmah between 4,000 and 9,000 feet, keeping more to the open than to the very heavy forests, though even in the former there are always pockets and ravines which have the trees and undergrowth very dense and tangled. It is also found on grass-covered hill-sides, well away from any large tree forest, and seems to keep together in small flocks, probably composed of the cock and hen and the last hatched brood.

Mr. J. P. Cook writes in the Bombay Journal of this Pheasant:

> "I saw this beautiful bird, or it may have been *P. burmannicus* "1331a" (this it proved to be) "several times, and generally "in the open jungle on rocky grass-hills. On one occasion I "put up five birds singly at intervals of about a minute or "two. At one time I thought I had found a nest, as a hen "bird rose at my feet, but I hunted everywhere without suc-"cess. These Pheasants do not seem to be quite so gregarious "as *G. lineatus*, nor so partial to the proximity of water. I "should like to have shot one or two, but when I saw them I "always had my little ·410 with me only, which would not have "been sufficient to have brought them down. On one occasion "I put up a Pheasant out of some wild raspberry bushes "amongst long grass, the fruit of which it was perhaps "feeding on."

PHASIANUS ELEGANS (Elliot).

Stone's Pheasant.

Phasianus elegans, Elliott, Ann. and Mag. N. H. (4), VI., p. 312 (1870); Sclater, P.Z.S., 1870, p. 670; Elliott, Monog. Phas., II., Pl. VIII (1872); Ogilvie-Grant, Cat. Birds B.M., XXII., p. 329 (1893); id Hand-L. Game-B., II., p. 31 (1897); Blanford Faun. Brit. Ind. Birds, IV., p. 81 (1898); Oates, Man. Game-B., I., p. 299 (1898); Styan, Ibis, 1899, p. 298; Davies, Ibis, 1901, p. 408; Buturlin, Ibis, 1904, p. 411, id Ibis, 1908, pp. 574, 576, 585. 592; Harington, Jour. B. N. H. Soc., XIX., p. 309 (1909); Sclater Ibis, 1912, p. 554; Ingram, Novit. Zool., XIX., p. 271 (1912); Bailey, Geog. Journal, XXXIX., p. 346 (1912); id Jour. B. N. H. Soc., XXII., p. 367 (1913); Bangs and Phillips, Bull. Musc. Comp. Zool., LVIII., No. 6, p. 269 (1914).

Phasianus sladeni (Anderson MSS.) Elliott, P.Z.S., 1870, pp. 404, 408; Anderson, P.Z.S., 1871, p. 214; Swinhœ, P.Z.S., 1871, p. 378; David and Oustalet, Ois, Chine, p. 411 (1877); Anderson, B.W. Yunnan Exp., p. 671, Pl. II. (1878).

? *Phasianus süchschanensis*, Bianchi, Bull. Acad. St. Petersb., V. Ser. T., XXIV., n. 1-2, p. 83 (1906); Buturlin, Ibis, 1908, p. 574.

Vernacular Names.—? Wucru (*Kachin*), Tso-ka (*Tibetan*).

Description—Adult Male.—Crown from forehead to nape and hind neck bronze-green, the ear tufts darker and more blue; chin and throat deep green; neck in front and on the sides deep purple blue with purple copper reflections in some lights, this colour passing round the base of the neck as a collar behind; upper back golden chestnut, changing into deep chestnut on the back and scapulars; the feathers next the neck are centred with black and their tips are notched with the same; the feathers of the back and the scapulars have black centres mottled and sub-out-lined with buff, and the same notches as on the upper back, but the black obsolete. Lower back, rump and tail coverts pale green-grey with sub-terminal bars of lustrous emerald green, and each feather with the concealed base black with buff concentric bands. Tail feathers rufous brown with broad black bars, narrowly edged above and below with golden buff; the central pair have wide margins of pink-grey, across which the black bands are continued as dull crimson purple marks; on each succeeding pair the pink edges are reduced in size, and are absent on the outermost pair, and sometimes on one or two of the next pairs also.

Wing-coverts pale green grey with emerald green reflections, and with the innermost greater coverts splashed with maroon, broadly on the outer and narrowly on the inner webs; quills brown, the primaries barred with buff on the outer webs and with broken bars on the inner; secondaries broadly edged with olive brown and irregularly marked with buff on both webs.

Below, breast deep glossy green, each feather narrowly margined with velvety black, and those on the lower breast notched, though less conspicuously so than on the back; flanks and sides of the breast golden copper, becoming almost purple copper next the green of the breast, each feather with a bold edging of velvet black, which runs down the end of the shaft towards the greenish base, vent, thighs, and centre of abdomen dull brown; under tail coverts chestnut with black marks.

Colours of the Soft Parts.

> "Legs and feet of the male lead colour, inclining to flesh "colour; naked skin around the eye scarlet." (Elliot.)

Measurements.—Wing 8·3″ (210·8 mm.) to 9·0″ (228·6 mm.), with an average for 20 males of 8·6″ (218·4 mm.); tail 15·4″ (391·1 mm.) to 19·2″ (487·6 mm.), generally between 17″ (432 mm.) and 18″ (457 mm.); bill from front about 1·2″ (30·4 mm.), and from gape about 1·4″ (35·5 mm.); tarsus 2·5″ (63·5 mm.) to 2·7″ (68·5 mm); spur about ·4″ (10·1 mm.).

Adult Female.—Crown and neck dark brown or black with narrow bars of buff, sometimes with a distinct tinge of chestnut; back and scapulars chestnut with white sub-edging, and very fine edges of black and a bold bar of the same between the chestnut and the white; remainder of upper plumage pale grey brown with narrow buff edges and black centres with here and there a tinge of chestnut shewing very irregularly. Central tail feathers pale olive brown with narrow paler cross bars broadly margined on either side with black; remaining tail feathers dull chestnut with similar bars; in all the tail feathers the markings are irregular, and somewhat mottled, giving a mottled appearance to the whole.

Below, the chin and throat are pale buffish, obsoletely barred with dark brown; foreneck and upper breast with bolder bars of black and black centres and washed with a pinky reddish tinge, lower breast, flanks and abdomen dull greyish buff with numerous faint vermiculations of grey-brown, and with visible centres of deep chestnut brown; under tail coverts the same marked with chestnut.

Three females from Chang Youn, in China, are more richly coloured above than any of the more Western birds, but, at the same time, have practically no dark markings on the lower breast and abdomen; the flanks and thigh coverts are, however, fully as boldly marked as the other birds.

Colours of Soft Parts—not recorded.

Measurements.—Wing 7·8″ (198·1 mm.) to 8·2″ (208·3 mm.); tail from 9·7″ (246·4 mm.) to 10·7″ (271·8 mm.); tarsus 2·4″ (60·9 mm.) to 2·6″ (66·0 mm.); bill at front about 1·1″ (27·9 mm.), and from gape about 1·3″ (33·0 mm.).

Distribution.—Western Szechuan, Eastern Tibet, at least as far West as Batang, Yunnan and the Northern Shan States and Kachin Hills and Southern Shan States.

As regards Tibet, Bailey says:

> "I shot a specimen of this on the Fei-Yueh-Ling Pass, South-"East of Ta-chien-lu. It was plentiful at Ta-chien-lu itself, and

> "a few were seen in suitable places up to Batang again in
> "Yangtse Valley, two days South of Batang and near the Kia-la."

Harington obtained a male at Ta-shio-tang, Tawnio State, Trans-Salwin; Major J. Whitehead got another male at Namsang-yang between Talawgyi and Lawchen, and a third was also obtained by Captain Bard in the same district close to Myitkina.

It is apparently found as far South in S. Shan States as 21°.

Nidification.—I can find nothing on record concerning the breeding of this Pheasant in a state of a nature.

I have two eggs in my collection which I owe to the generosity of Mr. Charles M. Inglis. They were laid by the hen of a pair kept by him in an aviary in Tirhoot, and are two of a clutch of 7.

In appearance they are typical Pheasants' eggs, exactly like many laid by *torquatus* and *colchicus*, in English woods and spinneys, and not like the *Gennæus* type of egg laid by *Phasianus humiæ*.

In colour they are a clear, deep fawn-brown, and in shape typical pheasants' eggs, though not of the extreme peg-top shape. The surface is very smooth and fine grained, and has a slight gloss. They are rather fragile eggs for their size, considerably thinner than the shells of eggs of tne Silver Pheasants.

The two eggs measure respectively 1·75″ (44·4 mm.) × 1·35″ (34·3 mm.) and 1·75″ (44·4 mm.) × 1·34″ (34·0 mm.).

General Habits.—Elliot records of the two specimens of this bird first brought home to England and deposited in the Gardens of the Zoological Society that they were very wild, and endeavoured to hide from anyone who approached their cage. He also say that:

> "The voice of *P. elegans* is harsh and guttural, very different
> "from that of any of its relatives."

On the other hand Harington says that its call is exactly like that of the English Pheasants.

Capt. Davies agrees with the latter, he writes:

> "Stone's Pheasants are common in Western Yunnan. They
> "are not usually found much below 4,000 feet, and are most
> "plentiful near the tops of the ranges at an altitude of from
> "6,000 to 8,000 feet, in long grass and fern, or in fir woods.
> "I have usually met with them singly or two together, but on
> "one occasion I saw a covey of ten. The crow of this bird is
> "hardly distinguishable from that of the English Pheasant,
> "and the noise the cock makes when flushed is also the same.
> "I have not often seen it in the Tibetan part of the country
> "(W. Szechuan) though I shot one a few marches South-West
> "of Li-tang at 10,500 feet."

Harington never succeeded in getting a second specimen, though he often heard them crowing. Those he came across were all on the almost bare hillsides covered merely with dry weeds and grass about four feet high, but with no trees or bushes.

(To be continued.)

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XVII.

(A).—The Shan States Langur.—A Correction.

BY

R. C. Wroughton.

In the last number of this Journal (p. 46) I described a series of langurs obtained by our Survey in the Shan States. I took (and gave) much trouble, in making sure that the species could not be *barbei*, Blyth, and concluded to give it the name *shanicus*. I regret to say that I completely overlooked a specimen in the British Museum Collection, obtained at Bhamo, by Fea, which Dr. Elliot made the type of his species *melamerus*, (A. M. N. H. S. 8, p. 267, 1909). This cannot be distinguished in any way from *shanicus*. The Shan States langur must, therefore, be known as *P. melamerus*, Elliot, with *P. shanicus*, as a synonym.

(*B*).—A new Indian Hare.

BY

R. C. Wroughton.

In connection with a summary of the results from our Mammal Survey, I have recently had to re-examine all the hares in the British Museum Collection. Among them I have found a series sufficiently distinct from the rest to deserve a name of its own.

It consists of four specimens, taken near the Sambhar Lake, in Rajputana, more than thirty years ago. These are allied by their brown-coloured scuts to *ruficaudatus*, Geoff., but their general coloration is so markedly and evenly like that of so many animals inhabiting sandy wastes, and at the same time so distinct from the coloration of all their neighbours, that it seems to me that I am justified in giving them a name. I propose to call them

Lepus rajput, sp. n.

A hare about the size of *ruficaudatus*, Geoff., or *simcoxi*, Wr., but differing from both by its bright buff colouring.

General colour above " tawny olive." The individual hairs of the lower back are white at their bases (8mm.) and thereafter a band of buff (12mm.) between a black band and a black tip (each 3-5mm.). Tail coloured like the back above, white below. Face and ears coloured quite like the back, but with the usual white blaze through the eyes. The nape and limbs ochraceous. The chin and belly pure white merging gradually into the buffy flanks.

Dimensions of the type.—Hindfoot, 103mm.; ear 105mm. (The dimensions of another very similar specimen are recorded by the Collector as follows:--head and body, 462mm.; tail, 112mm.; hindfoot, 107mm.; ear, 130mm.). Skull.—condylo-basal length, 78; zygomatic breadth, 42; greatest length of nasals, 41; posterior breadth of nasals, 21; breadth of nasals anteriorly, 16; palatal foramina, 21; diastema, 24; upper molar series, 15.

Habitat.—Rajputanȧ. (Type from Sambhar Lake).

Type.—Adult male. B. M. No. 85, 8. 1. 342. Collected by Mr. R. M. Adam and presented to the National Collection by the late Mr. A. O. Hume, I.C.S.

There seems to be no connection between *rajput* and either *dayanus* or *simcoxi*; in the coloration of its nape and scut it resembles *ruficaudatus*, of which it is possibly a desert form. The question of the exact status of the various named Indian hares is a most complex and difficult one, and I propose, for the present, to treat them all as species. Mr. Adam took three specimens of *rajput* near the Sambhar Lake, and Blanford a fourth in Alwar.

THE NOMENCLATURE OF THE GEOGRAPHICAL FORMS OF THE PANOLIA DEER (*RUCERVUS ELDI* AND ITS RELATIVES).

BY

OLDFIELD THOMAS.

Owing to the somewhat piecemeal way in which the Sangnai or Manipur Deer, commonly confused with the Thamin, was discovered, and the divided authority for its early description, a good deal of error has arisen as to the nomenclature of this Deer and its relatives, such as the giving and later withdrawal of the name *cornipes* by Lydekker.

And I now find that in the latter's latest work* certain essential points in the history of the animal have been overlooked, so that its nomenclature is still far from correct.

Recognizing *Rucervus* as a full genus, and raising to specific rank the three forms admitted by Lydekker, we may for the sake of clearness define them as :—

A.—With naked pasterns, Manipur ("*frontalis*" of Lydekker).

B.—With hairy pasterns; the horns not palmated. Pegu, Burma, &c. ("*eldi*").

C.—With hairy pasterns; the horns more or less palmated terminally. Siam and Hainan ("*platyceros*").

But if the nomenclature of each species is carefully investigated it appears that all the existing names applied to these animals (except *platyceros* and *siamensis*) were given to specimens originally from Manipur, as will be seen by the following synonymy :—

Nondescript species of Deer, McClell. Calc. Journ. N. H., I, p. 501, 1841, Manipur.

Cervus eldi, Editor (McClelland) Calc. Journ. N. H., II, p. 417, 1842. (Published at the suggestion of a correspondent, in a note to Lieut. Eld's account and drawings of the Manipur "Sungraëë").

Cervus (*Rusa*) *frontalis*, McClelland Calc. Journ. N. H., III, p. 401, 1843. (Based on Capt. Guthrie's specimens from Manipur).

Panolia acuticornis, Gray. List Mamm. B. M., p. 180, 1843. (Based on the account and figure in the Calcutta Journal, 1842, in which the name *C. eldi* was only incidentally mentioned in a note. Locality therefore Manipur).

Cervus lyratus, Schinz, Syn. Mamm., II, p. 395, 1845. (Based on McClelland's "Nondescript species of Deer" 1841), (Manipur).

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* Cat. Ung. B. M. IV, p. 100, 1915.

Panolia acuticauda, Blyth. P. Z. S. 1863, p. 370. (*Lapsus calami* for *acuticornis*).

Cervus eldi cornipes, Lyd. Nature LXIV, p. 257, 1901. (Based on a head and foot from Manipur, presented by Major C. S. Cumberland; B. M. No. 1. 7. 13. 1).

The whole of these names without exception refer to the Manipur stag, and to that alone. Consequently it is A, and not B, which should bear the name *eldi*, while *frontalis*, *acuticornis*, and the other names referred to are synonyms of it. For this animal also we may adopt the Vernacular name Sangnai and so avoid the term Thamin, which belongs exclusively to the next species.

The peculiarly modified naked pasterns of the Sangnai form a special character far greater in systematic value than anything that would be used merely to distinguish a subspecies.

For B, the Pegu Thamin, unspotted brown in the adult, with hairy pasterns and non-palmated horns, there appears to be no name available, and I would suggest that it be called *Rucervus thamin*. The adult male mounted in the Museum, from Pegu, presented in 1900 by Major (now Colonel) G. H. Evans, No. 0. 7. 23. 1 might be selected as the type. Col. Evans has given a good account of the animal in our Journal* and now tells me that the type was shot at Mohaingyi Escape, about 20 miles north of Pegu Town.

With regard to C, the palmated-horned Siamese and Hainan form, our knowledge is very imperfect. But the close similarity between the type horn (B. M. 695. h.), Schomburgk's fine skull No. 65. 11. 2. 1, and the highly characteristic horns from Annam collected by Dr. Vassal (8.11.1.18.) shows that the animal is sufficiently distinct to have a name. This, if *Rucervus* is recognized as a genus, should be *platyceros*, for Gray's *Panolia platyceros* is then not invalidated by Cuvier's *Cervus platyceros*, as Lydekker took to be the case.

Whether the Western Siamese form is *platyceros* or *thamin* remains to be proved, and it is possible that the two will be found to grade into each other, but I think it most convenient now to use a binomial for the comparatively well-known Burmese animal.

With regard to the Hainan representative of *R. platyceros* I am inclined to believe it forms a distinct local subspecies, which may be termed

Rucervus platyceros hainanus, subsp. n.

Horns smaller and weaker than those of true *platyceros* of corresponding ages. Snags at the junction of the brow-antler and the beam almost or entirely absent, these being large and conspicuous, often three in number, in true *platyceros*.

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* J. Bomb. N. H. Soc., Vol. IX, p. 326, 1895.

Hab.—Hainan.

Type.—Frontlet and horns, said to be of a five-year-old male; figured by Swinhoe, P.Z.S., 1869, p. 655, fig. 2; B.M. No. 70. 2.10.72. Ost. Cat. 695. q.

The older horns also figured by Swinhoe on the same page are unfortunately no longer in the Museum, but the drawing shows the very slight development of the basal snags, in marked contrast to their number and size in old horns of true *platyceros*. And if they are drawn to anything like the same scale as the others, they must have been very much smaller than old *platyceros* horns.

All the references to Formosa in relation to the Museum specimens of this Deer should be deleted from Lydekker's Ungulates and be replaced by Hainan. The error seems originally to have been made by Gray or Gerrard.

With regard to the distinction of the different forms of these Deer by the antlers, it may be said in a general way that the horns of the Sangnai (*R. eldi*) are long, thin, and rather smooth, without or with but small and few extra basal snags at the junction of the beam and the long brow-tine. In the Thamin (*R. thamin*) on the other hand, the horns are comparatively rough, and basal snags are always present, commonly 3-6 inches long, and in one fine pair of horns from Thatone (Hume Coll.) the extra snags on each side are no less than 11 and 8 inches in length. And in addition more than one snag may be present on a single antler.

Similarly in the more Eastern group the horns of *platyceros* are greatly roughened and may have from 2-5 basal snags on each horn, these occasionally attaining a length of 5 inches. Even a young pair of antlers (Coll. Sir R. Schomburgk) has three distinct "buttons" on each horn, one behind the others. In *hainanus* on the contrary, in five pairs one only has one small button on each horn, one has one on one side only, and the remainder are entirely without any trace of them. The much older horns figured by Swinhoe have two small knobs on one side and one on the other.

Of course throughout the series this development of knobs and snags is subject to the greatest variation, and wide departures from the normal must be expected in individual heads, but the above characters, based on the whole Museum Collection, give a general idea of the antlers found in the different forms.

P. S.—Since the above was written, the National Museum has received as a donation from Mrs. Manby a first and liberal selection of a very fine series of sporting trophies collected in Burma by her late husband Mr. C. W. A. Bruce, the author of several notes on Burmese shooting in Lydekker's "Great and Small Game of India, 1900."

Included in this valuable present are some skulls and horns of the Thamin (*Rucervus thamin*) from the Pegu Plains, and also two of the same genus from the Ruby Mines District.

These two latter, however, coming from quite a distinct area, appear to me to represent a special subspecies of the Thamin, which I propose to name in honour of the sportsman by whom the specimens were shot.

RUCERVUS THAMIN BRUCEI, subsp. n.

External characters, including foot structure, unknown.

Skull as in *R. thamin*, except that in both specimens the ridge which bounds on the upper side the lachrymal pit is comparatively little developed, its edge rounded, as compared with the strong and sharp edged ridge found in other members of the group.

Horns with much roughened surface. Brow-tine and beam not, as in all the other Thamins, in the same, or nearly the same, continuous line, but the former bent up at an angle more approaching what is found in the Swamp deer (*R. duvauceli*). Viewed from the side the ordinary Thamins have the brow-tine at about 170°-175° with the beam, that is, nearly straight, while in *R. t. brucei* it is slanted upwards at about 130°-140°. The same slanting up produces an angle of about 65° with the occipito-premaxillary line, as compared with about 40°-45° in others members of the genus.

Viewed from above the two beams are directed more backwards, comparatively little divergent from each other, the middle third of one beam forming an angle of 70° to 75° with the middle third of the other, therefore decidedly less than a right angle. In *R. eldi* and *thamin*, on the other hand, the two beams diverge widely outwards from each other, the middle third of one forming considerably more than a right angle (110°-120°) with the middle third of the other. This curvature is quite uniform in all the available adult specimens of *R. eldi* and *thamin*.

The tips of the antlers tend a little towards the broadening found in *R. platyceros*, but less developed than in that animal. The extreme tip consist in each case of two small subequal tines.

Supplementary tines at the junction of beam and brow-tine of moderate development, the type having one of 5 inches on one side and two small ones on the other; the second specimen has two small ones on each side.

Dimensions of the type:—

Skull, greatest length 345 mm.; condylo-basal length 320; zygomatic breadth 129; upper tooth row 82.

Horns, length round curve from base 772 (30·4 in.). Circumference of base 153 (6 in.) length of brow-tine 412 (16·3 in.). The longer horn of the second specimen is 830 mm. in length.

Hab.—Ruby Mines District, Upper Burma. Type from Thimbaung-gwin Plain.

Type.—Old male skull and horns. B. M. No. 17.7.8.17. Shot by the late C. W. A. Bruce, Esq. Presented by Mrs. Manby.

The fact that the district from which these two skulls come is a considerable distance from the type locality of any described form, and that they are quite like each other, the different curvature of their main beams, the bent up brow-tines, unlike those so characteristic of the present group, and the lesser development of the lacrymal ridges, taken together, appear to justify the distinction of the Ruby Mines Thamin as a special subspecies. This I have much pleasure in dedicating to the fine sportsman who discovered it, Mr. C. W. A. Bruce, to whose widow the National Museum is indebted for the specimens.

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A SELECTION OF LECTOTYPES OF INDIAN MAMMALS, FROM THE CO-TYPES DESCRIBED BY HODGSON, GRAY, ELLIOT AND OTHERS.

By Oldfield Thomas.

Nothing has so much contributed to the difficulty in working out Indian Mammals, and the confusion that has reigned in their arrangement, as the vagueness with which the identification of the typical specimens of the early Indian describers has been dealt with, and there could certainly be no greater lesson as to the vital advantage of an original selection of types than a study of the history of Indian Mammalogy for the last 80 years, with the confusion and innumerable errors which non-selection has given rise to.

Such an original selection was not of course practised by, or known to early writers, and even Blanford, so well balanced and sensible in other things, was at first inclined to be against selection, and it was only as he gradually absorbed the lesson referred to, that he was induced towards the end of his life to select types of the species he described.

The primary difficulty in the case of Indian Mammals was an outcome of the wonderful work done in Nepal by Brian H. Hodgson, who described and figured in various journals both in India and England the many mammals which he discovered. Writing in Nepal, away from books, collections and Museums, he not unnaturally made many mistakes, and indeed it has been sarcastically said that "every animal in India has two names, one its proper name, and the other which Hodgson gave it," but in spite of all, he was the real pioneer of Indian Mammalogy, and the maker and donor of the finest collection ever made in that country until the inception of the Bombay Natural History Society's Mammal Survey.

Now Hodgson described mammals in the country as he got to know them, such knowledge coming from living specimens he saw or kept alive, and the collection that he gradually built up. No particular individual was ever selected as a type, and as more and more later specimens were added to the collection, great difficulty was found in obtaining any exact definite idea of the animals to which his name should technically be attached.

Owing moreover to the fact that he sent other specimens to Calcutta, to the Museums of the Zoological Society and the East India Company and further collections to the British Museum, and that most of these gravitated into the National Museum in course of time, the series representing his species is often very large, and it has often been with great difficulty that specimens which could be called typical have been identifiable.

Gradually however in recent years, with the help of Messrs. Wroughton and Lydekker, the supplementary and later specimens have been eliminated, and "co-types" selected for many of Hodgson's names, such co-types being so far as practicable chosen from the collection he sent as forming a first typical set to the National Museum in 1843 and 1845.

Now however in connection with an important paper by Mr. Wroughton summarizing the progress of Indian Mammalogy since the date of Blanford's Mammals of India, a paper in which the types of all the described Indian Mammals will be designated, it has seemed advisable for the official Zoologist in charge of the Museum collection of Mammals to select definitely "Lectotypes" from the co-types, so as to avoid the perpetuation of the confusion that has hitherto reigned. Such a formal selection, made after comparison, with the other co-types, and examination of the original descriptions, entries in registers and other pertinent notes, published and unpublished, is a proceeding which gives these lectotypes the status of full types (holotypes) and is not liable to later reversal unless definitely proved to be erroneous. The whole subject will therefore be very materially simplified.

Although the Hodgson types are the most important, owing both to their number and the diverse methods in which his species were published, yet it has been thought advisable to treat all the other Indian Mammals in the same way, including those of Elliot, Gray, Horsfield, Blanford and other writers.

The following list therefore designates a lectotype for every Indian species which has not already had a single type nominated for it.

The designation is simply by the Museum register number in each case, and no detailed account of locality, or specification of other co-types, is now thought necessary, as these details, if wanted, are obtainable from other sources. In fact most of them will be found in Mr. Wroughton's forthcoming paper.

Since however when one of the several co-types is selected as a lectotype, the others lose their primary typical status, I have thought it advisable so to label the latter that later workers shall not be led astray by making comparisons with specimens marked as "co-types" without further indication. These specimens being now placed, in relation to their respective lectotypes, exactly in the position that paratypes are in relation to types, when originally selected as such, I have labelled them as "lectoparatypes" my selection of them as paratypes corresponding to the selection of their preferred brothers as types, that is lectotypes.

With regard to the very difficult question as to what generic names the species should be placed under in such a list as the present, I have cut the knot by assigning every one to the genus to which it would now be referred, irrespective of that under which it was first described.

With the help of Blanford's Mammals, and Wroughton's forthcoming list, the proper identification of every name should be quite without difficulty, while the complexity resulting from putting the original names, and thus perhaps using several different names in a single genus, is avoided.

The same difficulty is treated in the opposite way in Lyon and Osgood's Catalogue of types in the United States National Museum, 1909, but that is so large and important a work as to carry its own explanations with it.

It should be understood that the publication of the present list is only in preparation for the more complete paper by Mr. Wroughton, who has thought it better that the selection of lectotypes should be done by the person officially responsible for their custody.

Pithecus schistaceus, Hodgs.	Skin and skull	♂.	43.1.12.1.
Loris lydekkerianus, Cabr.	Skin and skull		3.2.19.1.
Pteropus leucocephalus, Hodgs.	Skin and skull	♂.	45.1.8.273.
Cynopterus marginatus ceylonensis, Gray.	In alcohol.	♂.	58.10.19.12.
Cynopterus m. ellioti, Gray.	Skin and skull	♂.	40.k.
Rhinolophus tragatus, Hodgs	In al.	♂.	43.1.12.135.
Hipposideros lankadiva, Kel.	Skin and skull	♂.	7.1.1.311.
,, *armiger*, Hodgs.	In al.	♂.	43.1.12.132.
Scotophilus heathi, Hodgs.	Skin and skull	♂.	7.1.1.446.
Kerivoula picta, Pall.*	In al.	♂.	67.4.12.342.
Erinaceus megalotis, Bly.	Skull only		79.11.21.515.
Soriculus caudatus, Horsf.	Skin and skull		79.11.21.479.
Felis erythrotus, Hodgs.	Skin and skull		43.1.12.6.
Viverra melanura, Hodgs.	Skin and skull	♂.	43.1.12.25.
Prionodon pardicolor, Hodgs.	Skin	♀.	43.1.12.10.
,, *maculosus*, Blanf.	Skin and skull	♂.	85.8.1.28.
Mungos urva, Hodgs. (and *cancrivorus*, Hodgs.).	Skin and skull†	♂.	43.1.12.33.
,, *jerdoni*, Gray.	Skin and skull	♂.	46.11.9.5.
,, *nyula*, Hodgs.	Skin and skull	♀.	43.1.12.18.
,, *auropunctatus*, Hodgs.	Skin and skull	♂.	43.1.12.20.
Vulpes ferrilatus, Hodgs.	Skin only		45.1.8.213.
Martes toufœus, Hodgs.	Skin only		45.1.8.262.
Mustela temon, Hodgs.	Skin and skull	♂.	58.6.24.115,
,, *subhemachalana*, Hodgs.	Skin		43.1.12.12.
Ailurus ochraceus, Hodgs.	Skin and skull		43.1.12.35.

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* *cf.* P. Z. S. 1892, p. 316.

† Skull separately registered ; 45.1.8.54 ; 144*b*.

Lutra macrodus, Gray.	Skin and skull	♂.	46.11.9.11.
Eupetaurus cinereus, Thos.	Skin only		88.9.28.1.
Petaurista philippensis, Elliot.	Skin and skull	♂.	115.d.
,, *griseiventer*, Gray.	Skin and skull	♂.	198.a.
Pteromys alboniger, Hodgs.	Skin and skull	♂.	43.1.12.49.
Ratufa macruroides, Hodgs.	Skin and skull		43.1.12.76.
,, *elphinstonei*, Sykes.	Skin and skull	♂.	79.11.21.579.
Tomeutes lokroides, Hodgs.	Skin and skull	♀.	43.1.12.58.
,, *similis*, Gray.	Skin and skull	♂.	43.1.12.54.
,, *blythi*, Tytl.	Skin only	♂.	79.11.21.361.
Dremomys lokriah, Hodgs.	Skin and skull	♂.	43.1.12.55.
Tamiops macclellandi, Horsf.	Skin and skull	♂.	79.11.21.372.
Marmota hemachalana, Hodgs.	Skin and skull	(young)	45.1.8.237.
Marmota dichrous, And.	Skin and skull		76.2.12.3.
Tatera hardwickei, Gray.	Skin and skull	♂.	11.e.
Meriones hurrianæ, Jerd.	Skin only		67.2.4.1.
Bandicota nemorivaga, Hodgs.	Skin and skull	♂.	43.1.12.67.
Gunomys kok, Gray, and *providens*, Ell.	Skin and skull	♀.	30.c.
Rattus fulvescens, Gray.	Skin and skull	♂.	45.1.8.376.
Millardia meltada, Gray, *Golunda meltada*, Gray, *Mus mettada* and *M. lanuginosus*, Ell.	Skin and skull	♂.	34.a.
Leggadilla saxicola, Ell.	Skin and skull	♂.	32.d.
Mus cervicolor, Hodgs.	Skin and skull	♂.	45.1.8.383.
,, *urbanus*, Hodgs.	In al.	♂.	45.1.8.398.
,, *bactrianus*, Blyth.	Skin and skull	♀.	56.2.29.4.
,, *booduga*, Gray.	Skin only		37.a.
Golunda ellioti, Gray.	Skin and skull		38.a.
,, *watsoni*, Blanf.	In al. and skull	♀.	91.11.1.14.
Microtus wynnei, Blanf.	Skin and skull	♂.	8.3.9.18.
,, *blanfordi*, Scully.	Skin and skull	♂.	8.3.9.17.
Alactaga indica, Gray.	Skin and skull		44.9.15.4.
Acanthion hodgsoni, Gray.	Skin and skull	(young)	47.7.22.9.
,, *alophus*, Hodgs.	Skin and skull		53.8.16.11.
Lepus macrotus, Hodgs.	Skin and skull	♀.	43.1.12.39.
,, *dayanus*, Blanf.	Skin and skull		90.4.9.3.
Ochotona nepalensis, Hodgs.	Skin and skull		43.1.12.63.
,, *rufescens*, Gray.	Skin and skull		44.9.15.9.
,, *curzoniæ*, Hodgs.	Skin and skull		58.6.24.99.
,, *ladacensis*, Günth.	Skin and skull		75.3.30.2.
,, *macrotis*, Günth.	Skin and skull		75.3.30.3.

Bubalus bubalis fulvus, Blanf.	Skull and horns	♂.	91.8.7.215.
Capra falconeri cashmiriensis, Lyd.	Skull and horns	♂.	12.10.31.54.
,, *jerdoni*, Hume.	Skull and horns	♂.	12.10.31.52.
Budorcas taxicolor, Hodgs.	Skin and skull	♂.	79.11.21.662.
Capricornis thar, Hodgs.	Skin and skull	♂.	43·1.12.89.
Gazella bennettii, Sykes.	Skin and skull	♂.	42.8.6.9.
Muntiacus ratwa, Hodgs.	Skin and skull	♂.	43.1.12.123.
Manis aurita, Hodgs.	Skin		43.1.12.85.

DESCRIPTION OF A NEW LIZARD OF THE GENUS *ACANTHODACTYLUS* FROM MESOPOTAMIA.

BY

G. A. BOULENGER, LL.D., D.SC., F.R.S.

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Acanthodactylus fraseri, sp. n.

Habit rather slender, body moderately depressed. Head 1½ to 1⅔ times as long as broad, its length 3⅘ or 4 times in length to vent, its depth equal to the distance between the centre of the eye and the tympanum; a lanceolate concavity from the frontonasal to the middle of the frontal; snout obtusely pointed, 1½ times as long as the portocular part of the head, with rather sharp canthus and scarcely concave loreal region; nasals feebly swollen. Pileus twice as long as broad. Neck narrower than the head. The hind limb reaches the collar; foot 1¼ to 1⅓ times as long as the head; fourth toe, from the base of the fifth, as long as the head. Tail 1⅔ times as long as head and body.

Upper head-shields convex, smooth or slightly rugose. Suture between the nasals ¼ the length of the frontonasal, which is a little broader than long and broader than the internarial space; præfrontals a little longer than broad, forming an extensive median suture; frontal shorter than its distance from the end of the snout, 1⅔ to 1¾ times as long as broad, rounded in front, narrow behind; parietals as long as broad or slightly broader than long, outer border concave. 3 or 4 large supraoculars, first shorter than second, fourth small or replaced by granules; 5 or 6 superciliaries, first longest and in contact with the first supraocular, the others separated from the supraoculars by a series of granules. Anterior loreal shorter than second; 4 upper labials to below the centre of the eye, the fourth the longest; subocular sharply keeled below the eye and forming an angle wedged in between the fourth and fifth upper labials. A strongly keeled upper temporal, followed by one or two smaller shields; temporal scales granular, smooth, upper very small, lower large; a narrow tympanic shield; 4 pointed scales forming a denticulation in front of the ear-opening.

5 pairs of chin-shields, the 3 first in contact in the middle. 28 or 29 imbricate gular scales in a straight line between the symphysis of the chin-shields and the median collar-plate, enlarged towards the collar. Collar free, curved, composed of 10 or 11 plates.

Scales granular and smooth or feebly keeled on the nape, rhombic and strongly keeled on the body, larger and imbricate towards the tail, a little smaller on the sides; 48 to 50 scales across the middle of the body, 18 to 20 in a transverse series between the hind limbs. Ventral plates tessellated, forming angular transverse series, as long as broad or slightly broader than long; 29 or 30 transverse series, the longest containing 16 plates. Præanal plate small and irregular in the female; male with a median series of 3 transversely enlarged plates.

18 to 23 femoral pores on each side, the two series narrowly separated in the middle. Fingers feebly serrated, with 4 series of scales; toes more strongly serrated, especially on the outer side of the fourth, the denticles of which are a little shorter than the diameter of the toe: 19 to 23 strongly unicarinate lamellæ under the fourth toe.

Upper caudal scales much larger than the posterior dorsals, oblique, obtusely pointed, strongly and diagonally keeled, the basals nearly as long as broad, lower feebly keeled, smooth in the basal part; 28 or 30 scales in the fourth whorl.

Greyish above, with four longitudinal series of darker spots on the back and a rather indistinct darker network on the body, white beneath.

	♂	♀	
From end of snout to vent	73	60	millim.
,, ,, ,, ,, ,, fore limb.........	29	22	
Head......................................	19	15	
Width of head	13	9	
Depth of head	9	7	
Fore limb	24	20	
Hind limb.................................	41	32	
Foot	22	18	
Tail	...	102	

Two specimens, male and female, were obtained by Capt. F. C. Fraser, I.M.S., at Zobeir, Shaiba, Lower Mesopotamia, and presented by him to the Bombay Natural History Society.

In proportion and general appearance this species resembles *A. savignyi*, Aud. (*vaillanti*, Lataste), but it differs from it in having four series of scales round the fingers, as in *A. cantoris*, Gthr., *scutellatus*, Aud., and *grandis*, Blgr., and the ventral plates not forming longitudinal series. In the latter character it agrees with *A scutellatus*, which differ in the acutely pointed snout and the stronger pectination of the toes.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams

BY

F. Wall, C.M.G., C.M.Z.S., F.L.S., Lieut.-Colonel, I.M.S.

Part XXIV (with Plate XXIV and Diagram.)

(Continued from page 215 of Volume XXIII.)

Family—Typhlopidæ.

(Greek "tuphlos," blind, "ops"=Eye.)

In the scheme of ophidian classification laid down by Boulenger in his catalogue of the Snakes in the British Museum published in 1896, the blind snakes are included in the two first of the nine families, *viz.*, Typhlopidæ and Glauconiidæ. The species of these two families are easily recognised from all other snakes by having ventral shields that are not enlarged. The species of the former family are peculiar in having four supralabials, whereas in the latter there are only two, the 1st situated in front of, and the 2nd behind the ocular shield (see figure A 4).

The family Typhlopidæ comprises the most degenerate of all ophidian forms, their degeneracy being inferred from their eyes which are purblind, their locomotion which above the surface of the ground is very laboured, and their extremely defenceless condition, for they have no weapon of offence or defence. The mouth being small, placed beneath the snout and having few and no opposable teeth, is incapable of grasping anything but minute objects. Their existence depends upon the subterranean life to which they have adapted themselves, and by which they escape annihilation from a host of rapacious foes. The family embraces three genera (1) *Helminthophis* including 5 species all inhabiting tropical America, (2) *Typhlops* including over 100 species inhabiting parts of all five Continents, (3) *Typhlophis* represented by a single species inhabiting Brazil and Guiana.

Genus—Typhlops.

The type of this genus is the S. American *T. reticularis*, described by Schneider in 1801. The genus contains many of the most diminutive of snakes, some only attaining to a length of but four or five inches in their adult state. They live for the most part beneath the soil, and subsist upon worms, grubs and insects. The eye is situated beneath one or more shields, and is thus protected from injury when the snake is burrowing. Vision is more or less obtuse at the best, but becomes more and more obscured as a period of desquamation approaches, from scratches sustained during burrowing operations. Some of the species are endowed with a minute spine at the tip of the tail which is directed downwards, with which they anchor the posterior part of the body, and against which they can push, or retract the rest of the body. Many are not so endowed, and some of these, but by no means all, have the snout provided with a beak directed downwards. Those with the snout rounded appear to burrow as expeditiously beneath the soil as the beaked species, so that the beak cannot be claimed as a specialised burrowing organ.

Very little is known of the habits of these snakes, many of the species of which indeed are only known from solitary specimens. They are believed to be oviparous in habit, but I am not aware of any authenticated instance of the eggs of any of them having been deposited. Some of the species have been observed to exhibit a gregarious disposition, but whether the attraction is supplied by the rich store of food a rotten trunk or log has to offer, or is related to the sexual functions is not certain. It may be that like other snakes they pass through a period of inactivity, and during the hibernating season, seek for warmth in their retirement, such as rotting wood generates. In such an environment they are amply supplied with sustenance in the form of maggots and chrysalides of beetles, ants, and other insects. Further as many snakes (perhaps all) during their retirement live in company with a mate, it is often at this time that conjugal duties are initiated. If this is so a third object is gained by the formation of colonies. Once I saw a colony dislodged from beneath the soil, but I am not prepared to say that in the jungle where this occurred, there may not have been rotting roots in which the members were embedded.

The head is covered with shields having a form and relationship that is peculiar to this family, and the Glauconiidæ. The scales on the body of these creatures are very highly polished and this appears to be a special adaptation with the object of preventing earth adhering to them. Owing to this polish it is difficult to see their outlines. As in many cases too a subterminal dark line is seen near the scale margins, which seems to indicate the edge of each scale, one is very easily misled as to the real limits of the scale. In some species especially, even when the head or body is dipped into red or black ink to throw up the scale borders, it is extremely difficult to ascertain with certainty the details one is specially looking for. The difficulty in many cases is materially increased by the diminutive proportions of the specimen under examination.

To count the costal rows round the body is almost impossible unless both hands are free, and one has to accustom oneself to the use of a powerful watchmaker's lens. With this in the eye (and it must be remembered that the eye not in use must be kept open in order to retain the lens) the snake is grasped in both hands, and gradually rolled round as one rolls a cigarette, the eye never straying or blinking while the count is being made, and it is necessary to make a pinprick or some such mark on one of the scales from which the count is commenced, or transfix the specimen with a fine needle. With the head shields too it is necessary usually to have the freedom of both hands, but some points may have to be elucidated with the aid of a glass much stronger than that of the usual watchmaker's lens. I have a special lens made by Messrs. Baker and Co., Opticians, Holborn, for this work, and the examination of teeth, etc., in minute skulls. I have also used a special make of watchmaker's lens with double glasses, employed in the trade to examine the holes in watches in which gems are set, and this has proved suitable for the fine work the examination of these snakes necessitates. With the best lens available, however, it is impossible to see the true outline of the scales unless the light is allowed to strike obliquely across them, a trick which takes a little time to acquire dexterously.

Within our Indian limits 20 species have up to the present been differentiated, the three commonest of which form the subject of this paper.

All the species are probably a great deal commoner than Museum collections make it appear. Natives usually take them for worms, and in consequence rarely bring them in for rewards. Most Europeans too do not recognise the smaller varieties as snakes.

TYPHLOPS ACUTUS.

(Latin "acutus" sharp pointed, in reference to the beak.)

The Beaked Blind Snake.

Described by Dumeril and Bibron in 1844. It is not uncommon. In Malabar it is called "kooroodam pamboo" meaning "blind snake," a term applied equally in the same locality to the cæcilian *Uræotyphlus oxyurus*.

Identification.—It is the only Indian species with a beaked snout.

Length.—Grows to about two feet.

Colour.—Brownish or blackish above, paler beneath. Each scale with a transverse lighter mark.

Habits.—It lives beneath the ground, or takes refuge beneath stones, and other objects, and sometimes strays into houses. It uses the beak on the head much in the same way that other species which are furnished with a spine on the tail use that little organ.

and when handled presses the beak into one's skin. It burrows dexterously in loose soil. Above the soil it is restless and endeavours to bury itself as speedily as possible. It is believed to feed on worms. Nothing is known of its breeding habits.

General characters.—Snout pointed and furnished with a sharp hook directed downwards, from which a horizontal edge passes backwards. Eye visible, beneath the nasal, and ocular shields. Nostrils beneath the snout, and close to the rostral. Neck not distinguishable. Body stout, and of even calibre throughout. Tail short and terminating in a small spine directed downwards, and slightly backwards. Diameter of body about $\frac{1}{40}$ to $\frac{1}{60}$ the entire length.

Lepidosis. Rostral—Very large; extending behind the level of the eyes; about $\frac{1}{2}$ the breadth of the head. *Nasals*—Not meeting behind the rostral; completely divided. The suture above the nostril shorter than that below, the latter passing to the 2nd labial. *Præfrontal*, *frontal*, and *interparietal*—Small, progressively decreasing in size. *Supraocular*—Broader than parietals, touching two shields behind. *Præocular*—Small, touching 2nd and 3rd labials. *Ocular*—Not in contact with any labial. *Subocular*—Present, in contact with the 3rd and 4th labials. *Temporals* three. *Supralabials*—Four. *Costals*—Boulenger says in 28 to 34 rows at midbody. In the few specimens examined by me I find them 28 anteriorly, 24 to 26 in midbody, and 24 behind.

Habitat.—The Plains and low Hills of Peninsular India, South of the Ganges Basin.

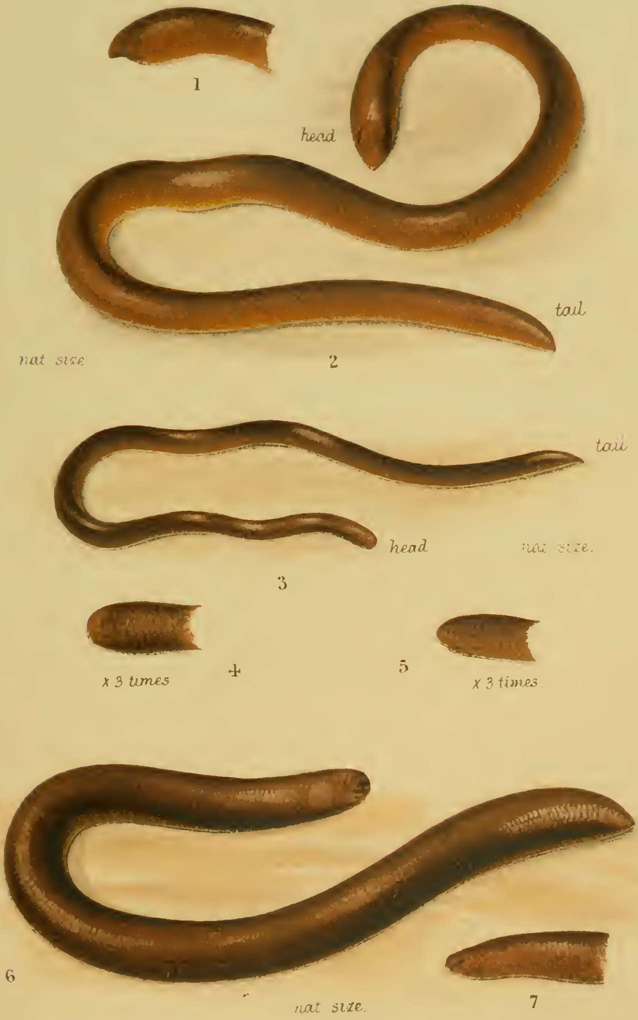
TYPHLOPS BRAMINUS.

THE BRAHMINY SNAKE OR COMMON BLIND SNAKE.

History.—First described and figured in 1796 by Russell in his first Volume (Pl. XLIII). Christened by Daudin in 1803 under the name *Eryx braminus*.

Nomenclature (*a*) *Scientific.*—The specific name is a latinised version of the word brahmin, and was given in reference to its brownish colouration. (*b*) *English.*—The Brahminy Snake seems to me suitable. (*c*) *Vernacular.*—The vernacular names "rendoo thalalay-pamboo" or "reti thalalay pamboo" two-headed snake, "sevi pamboo" ear snake, "poorän" centipede, "manallay "pamboo" earth snake, used by the Tamils, "depat-naya" two-headed snake, used by the Singhalese in Ceylon and "do mukh ka samp," two headed snake, generally used in India are loosely applied to any snakes of a burrowing habit. In the Cocos Islands it is called "ular minyah" according to Boulenger.

General characters.—This snake is cylindrical, and of even calibre in its whole length showing no indication where the head or tail begin. The head is bluntly rounded anteriorly and somewhat


1
head
tail
nat size
2
tail
head
nat size.
3
x 3 times
4
5
x 3 times.
6
nat size.
7

F. Gerhardt del. J. Green, Chromo.

THE COMMON INDIAN SNAKES. (Wall.)

1-2. Typhlops acutus, *harmless*. 3-5. Typhlops brahminus, *harmless*.
6-7. Typhlops diardi, *harmless*.

depressed. The eyes are indistinct, and the nostril directed somewhat downwards. The tail is very short and ends in a small spine directed downwards and backwards. The scales are perfectly smooth and polished. The diameter of the snake is about one-thirty-fifth to one-fifty-fifth the total length.

Identification.—It shows with *limbricki* (Annandale) the peculiarity that the suture below the nostril passes to the præocular shield and not to the 2nd labial, as in all the other species. It differs from *limbricki* in being smaller, and by its relatively stouter habit.

Dimensions.—Grows to about 6 or 7 inches.

Colour.—Three colour varieties have been described.

Variety (*a*) *typicus* is brown or blackish-brown above, rather lighter beneath. The snout, anal region, and end of tail whitish. This is much the commonest variety.

Variety (*b*) *arenicola* (Annandale).—In this each scale on the back is faintly tinged with buff, those on the head being faintly vermiculated with the same hue. In life it appeared of a pale flesh colour. The belly is white. Dr. Annandale met with this in S. India.

I have also met with specimens of a pale grey colour like a new slate pencil. The eyes were invisible. This colour may be a passing phase due to approaching desquamation. The specimens were from Assam.

Habits.—The Common Blind Snake is not often seen by Europeans or if seen is not recognised as a snake, its size and general appearance allowing it to pass for an earthworm. It spends most of its life beneath the surface soil, through which it burrows nimbly, and is often brought to light by the mali's hoe, or the ryot's plough. It is likely to be met with by the amateur gardener in and about his pots, in the heap of leaf mould, or in the soil freshly turned over by the trowel. It not infrequently secretes itself beneath stones or debris. After heavy rains it is not infrequently seen on the ground by those who can recognise it, after being swamped out of its subterranean burrows. On such occasions it is met with singly, but it has been occasionally discovered in large colonies inhabiting rotten wood.

It is an active little creature, making vigorous attempts to escape if dislodged from its hiding place. When handled it shows its resentment by vehement struggles, and is most difficult to hold owing to the high polish of its scales. When its struggles have quieted down it presses the little spine with which its tail is endowed, into the hand, anchoring itself as it were and from the purchase so derived wriggles about restlessly in all directions, pushing its nose about, and insinuating itself forcibly between the clefts of one's fingers. It is able to move backwards and forwards, but though it wriggles about with much muscular effort I have always noticed that its progress above ground is very slow. Under excitement it protrudes the tongue like other snakes. This organ is bifid as in other snakes, and white at the tip.

This is almost certainly the species which some years ago invaded the water supply in Calcutta, many specimens finding their way into the pipes of distribution. Much surprise and consternation were evinced by timid residents when a living specimen appeared through the tap supply. It sometimes invades houses in considerable numbers, from the garden, or pot plants. Captain Stevenson, I.M.S., told me that in Manipur it is extremely common in houses. He has found 3 in a single evening wriggling about the floor when he was dressing for dinner, and one subaltern in his regiment collected about one hundred in his house in about a month.

This species affords considerable sustenance to the young of the common krait (*Bungarus cœruleus*). In Fyzabad I cut open no less than eight young kraits, and found one or more of these blind snakes in their stomachs.

Parasites.—This is one of the many snakes known to harbour the nematode, intestinal worm called *Kallicephalus willeyi* by Von Linstow.

Food.—Most of those that I have dissected have had full stomachs and the contents when investigated proved to be the larvæ, pupæ, and imagines of ants, and probably beetles, and other insects. Dr. Annandale discovered one in the burrow eaten by a caterpillar in a stalk of sugarcane. The caterpillar had vacated or perhaps had been eaten by the snake, and subsequently in captivity the snake was observed to eat the caterpillar droppings.

Breeding.—The brahminy snake is believed to be oviparous, but I am not aware of any certain evidence in this direction. All the gravid females I have known were in Assam, and these eight in number were collected in the hot weather from April to July. In length they ranged between 6'' and $6\frac{3}{8}$.'' Six of these were brought to me on the same day by the same boy, who had evidently unearthed a colony, and only one male was brought with them. The eggs which whilst in the abdomen resemble grains of cooked rice varied from 2 to 7 in number, the largest measuring $\frac{18}{32}'' \times \frac{5}{32}''$.

Legends.—The Tamil names "Sevi pambu" or "ear snake" and "poor an" or "centipede," I am told by Dr. J. R. Henderson are applied because both this snake and the centipede, are popularly supposed to enter the human ear.

Lepidosis.—Snout rounded. *Rostral*—About one-third the width of the head, hardly extending to the level of the eyes. *Præfrontal*, *frontal* and *interparietal*—Subequal. *Supraocular*, *præparietal* and *postparietal*—Subequal. *Nasals*—Quite divided; the suture above the nostril much longer than that below; the latter extending to the præocular; not in contact behind the rostral. *Præocular*—Large,

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Explanation of Diagram.

A 1, 2 and 3. *Typhlops braminus* (much enlarged)

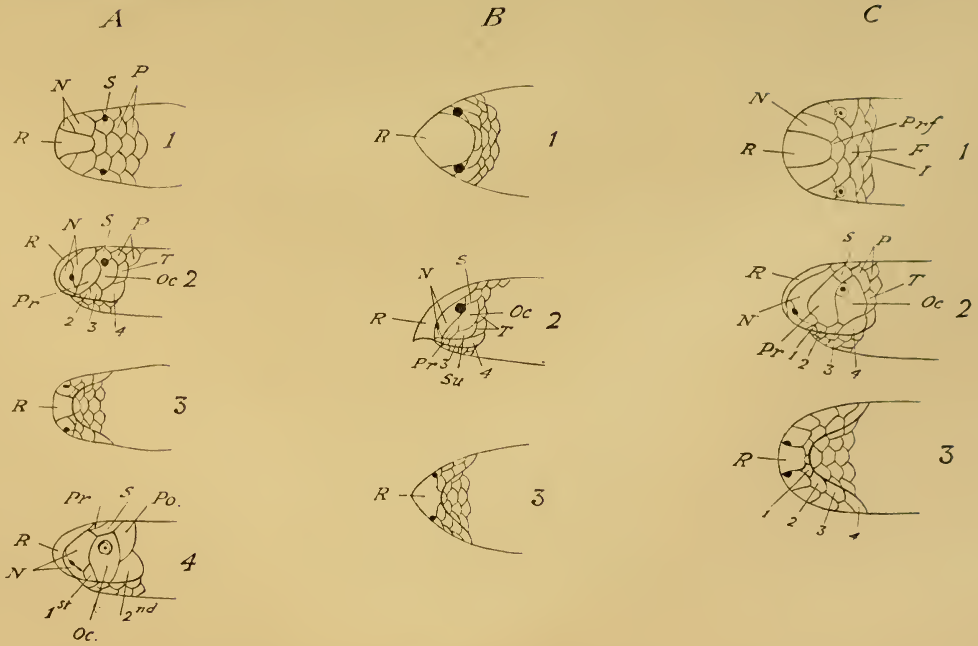
A 4. *Glauconia blanfordi* (much enlarged).

B 1, 2 and 3. *Typhlops acutus* (× 4).

C 1, 2 and 3. *Typhlops diardi* (× 2).

F.	Frontal.
I.	Interparietal.
N.	Nasals.
Oc.	Ocular.
P.	Parietals.
Po.	Postocular.
Pr.	Præfrontal.
R.	Rostral.
S.	Supraocular.
Su.	Subocular.
T.	Temporals.
1 to 4.	Supralabials.

Diagram.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4

The Common Snakes of India.

in contact with the 2nd and 3rd labials. *Ocular*—Touching the 3rd and 4th labials. *Subocular*—Absent. *Temporal*—One. *Supralabials*—Four. *Costals*—In 20 rows in whole body.

Distribution.—South Asia from Arabia in the West, throughout India, Assam, Burma, and the Malayan Continent to South China. The Malayan Archipelago to the Philippines. Islands of the Indian Ocean, Ceylon, Cocos, Andamans (not hitherto recorded from the Nicobars), Mauritius, Madagascar, Comoros. Africa at Cape Colony and North America. It is quite a common snake in every part of the plains I have visited.

TYPHLOPS DIARDI.

DIARD'S BLIND SNAKE.

Described by Dr. Schlegel in 1844. After *braminus* this is much the commonest of our blind snakes. In Burma it is called "mywe-hsin-pyit" meaning literally "elephant darting snake." There is a legend that it can spring off the ground and strike its foe, and it is believed to be so venomous that if it strikes even an elephant the creature will soon sicken and die.

Identification.—The scale rows are 24 or 26. It will be recognised if it has 24 rows, by the partial suture above the nostril, and the absence of pits beneath the snout. If the rows are 26 a rounded snout will differentiate it from *acutus*, the only other species with a similar number of rows.

General characters.—Snout rounded, nostrils lateral. Eye fairly distinct; beneath the ocular shield. Neck not apparent. Body stout, cylindrical, of uniform calibre throughout. Diameter $\frac{1}{29}$ to $\frac{1}{35}$ the total length. Tail short, with a small spine terminally directed downwards, and slightly backwards.

Length.—Up to 17 inches.

Colour.—There are two varieties (*a*) *typica*. This is black or blackish above, lighter below. The eyes very distinct. (*b*) *cinereus* (Wall). Pale grey like a new slate pencil, the eyes very indistinct. The latter I have only seen in Assam, where it is much the scarcer of the two.

Habits.—This the largest of our blind snakes with the single exception of *acutus* lives like the other species for the most part beneath the soil. It is rarely seen on the surface unless thrown up with recently disturbed soil, dislodged from beneath stones and debris, or swamped out of its natural haunts by heavy rains. When unearthed it struggles most strenuously to regain safe quarters beneath the soil, which if loose it burrows into with great ease, and is soon lost to view. Its movements above ground though energetic are not conducive to progress. In water it swims expeditiously and strongly. The high polish on its scales makes it a most difficult creature to maintain in one's grasp, and it wriggles unceasingly. It is quite unable to bite one, the mouth being too small to gain a grip on the skin. Under excitement it protrudes the tongue which is a bifid organ as in other snakes.

Dentition. The upper jaw bones are placed transversely in the mouth, and each bears 4 or 5 teeth. There are no other teeth at all.

Food.—Its food consists in the main of the larval, pupal, and adult forms of ants, but other insects in their various metamorphic stages are also devoured.

Breeding.—In Assam and Burma it breeds in the hot weather. I obtained gravid females in April, and Captain F. E. W. Venning a gravid specimen in the Chin Hills in June. The embryos attain a considerable degree of development inside the egg before the latter is discharged. We do not know yet whether the egg is voided as such or whether the embryo develops to such a degree that it is able to rupture its envelope inside the mother, and be born alive as in the case of most vipers, sea snakes, and some other ophidians. It is probable however that the embryo attains but a limited degree of development in the egg before it is discharged, as we know to be the case with some snakes notably certain species of *Dendrophis*, and *Dendrelaphis*, *Lachesis monticola*, etc. From 5 to 8 eggs have been observed in one female.

Lepidosis.—*Rostral*—About one-third the width of the head. *Præfrontal, frontal,* and *interparietal*—Subequal. *Supraocular* and *præparietal*—Broader than the postparietal. *Nasals*—Semi-divided; the suture above the nostril nearly reaches the rostral, and is about one-third to one-fourth the suture below it; the latter suture passes to the 2nd labial. *Præocular*—Large, in contact with the 2nd and 3rd labials. *Ocular* large, in contact with the 3rd and 4th labials. *Subocular*—Absent. *Temporals*—Two. *Supralabials*—Four. *Costals*—In 26 rows anteriorly (rarely 24), 24 or 26 rows in midbody, 22 (sometimes 24) behind.

Habitat.—The Teesta and Hooghly Rivers form its Western boundary and it extends from there through the Brahmaputra, Irrawaddy-Salween, Menam, and Mekong Basins and as far South as the Malayan Peninsula. It has been recorded from the Eastern Himalayas (Paniaghatta and Buxa Dooars) by me, from the Khasi Hills by me, from the Abor Hills by Dr. Annandale and from the N. Chin Hills by Captain F. E. W. Venning.

Our plate is in every way excellent.

(*To be continued.*)

TWO NEW INDIAN DRAGONFLIES.

BY

Capt. F. C. Fraser, I.M.S.

1. *PHYLLOMACROMIA NILGIRIENSIS* n. sp.

Male unknown.

Female: Expanse 68 mm. Length 41 mm.

Head broad, very large: eyes large, broadly contiguous, rich olive green above, bottle-green beneath: occiput small, black: upper border of occipital cavity fringed with short, stiff hairs: vesicle and clypeus brilliant metallic green, the former very prominent and broadly and shallowly notched above: the ocelli poorly developed, the lateral ones lying somewhat behind the vesicle: labrum lemon yellow: labial palps very large and foliate. lemon-yellow at the base, brownish along the borders: labium large, transversely oval, a dirty brown in colour.

Prothorax comparatively bulky, the lobe small, brown.

Thorax narrow and comparatively small, brilliant metallic green with a lateral bright lemon-yellow stripe and a triangular spot of the same colour at the posterior border. Both of these markings are continuous under the abdomen to meet those of the opposite side, the latter bearing a linear. black mark about its middle. *Thorax* coated with short downy hair.

Legs long and slim: femora 1 with a small tuft of hairs at its distal end, black: femora 2 black with yellow markings, spines stouter and more numerous than those of femora 3, the latter black, with a row of sparce, fine hairs gradually lengthening towards the distal end: the yellow markings on femora 1 more extensive than those on femora 2. Anterior tibiæ black. the others yellow: tarsi black: claw-hooks well developed and at the extreme end of the claws, making the latter appear as if bifid.

Wings: forewings rounded at the apex and narrow: hindwings very broad, with no tornus, the base being broadly rounded and approximating to the shape of some of the male Euphoea: both hyaline with a faint smokiness towards the apices and a rich amber suffusion towards the bases extending as far as the distal end of the cubitus where it gradually fades away: node in forewing well distal to the middle of wing, in the hind, well proximal: antenodal nervures 12 to 13, the final complete: trigone of both wings almost equilateral, the hind one considerably larger than the fore, the hind one well distal to the arc. both entire: arc between 2nd and 3rd antenodal nervures, a little distal to the 2nd; sectors of arc in both wings fused for a very long distance (rather more than 1 mm.): one cubital nervure in the forewing, 2 in the hind: subtrigone in the fore about the same size as in the hindwing: hypertrigone of forewing traversed by one nervure, that of the hind free: 4th (nodal sector) and 5th (subnodal sector) nervures very sharply convex opposite the stigma: 5a of remarkable length and reaching nearly to the termen: 1 row of cells between 5 and 5a: 7a absent: discoidal field narrow, broadly dilated at the termen, one row of cells in its inner two-thirds; anal loop small, only 9 cells, stunted, its external angle a little external to the outer angle of the trigone: membrane moderately large, white. Stigma small, 2 mm., lozenge-shaped as in the Agrionines.

Abdomen moderately long and slender, 1st and 2nd segments ventrodorsally dilated, 3rd to the 6th attenuated and much compressed laterally, 7th, 8th and the 9th markedly dilated and depressed, 10th very small, the last few segments with a low keel. Black with a yellow, skull-like mark on the dorsum of the 2nd segment, very similar to that seen on the Thorax of the Death's Head moth.

Anal appendages very short and pointed, black. Very similar to those of the Agrionines. Vulvar scale conspicuous, acuminate, ridged and transversely striated in its distal part.

Habits.—This rare insect, of which I only possess one specimen, belongs to the *Phyllomacromia* and is the first of its genus to be reported from India. Its specific characters are the non-prolongation of the trigone with the arc, the entirety of the trigones, the dilatation of the 8th abdominal segment and the single row of discoidal cells.

The single female specimen was taken in a marsh at the foot of the Nilgiri Hills above Kalar at 2,000′ altitude last June whilst in the act of depositing its eggs in very shallow water. Although I visited the same spot frequently afterwards in the hopes of obtaining more specimens, I never saw another. It has a very feeble flight.

2. *HYLÆOTHEMIS FRUHSTORFERI*, Kirby.

(Kirby Catalogue of Neuroptera-Odonata, p. 44, 1890.)

(*Tetrathemis fruhstorferi*, Karsch.)

Ris, 1911, in his work on the Libellulines, states that the female of this insect is unknown and I know of no description published since that date.

In his description of the male, made from dried and obviously faded specimens, he gives the markings of the insect as yellow but in the living state yellow marked males are exceedingly rare.

Blue marked specimens almost invariably fade to a yellowish tint so that Ris may have fallen into a very natural error when describing the males. The following is a description of both sexes made from living specimens.

Male: Expanse 60 mm. Length 38 mm.

Head moderately rounded: eyes very shortly contiguous, bottle-green above, yellowish-green beneath: labium bright yellow, its inner border and the middle lobe, black; front rounded, without a marked rounded anterior border, it and the vesicle a brilliant metallic green, the latter moderately large and almost imperceptibly notched: epistome and lower part of face, bright yellow: sutures moderately deep: occiput black with a spot of bright yellow posteriorly.

Prothorax: lobe large, projecting, rounded and notched centrally, furnished with a fringe of long hairs along its posterior border. Black with a blue collar anteriorly, an angular spot on the mid-dorsum and the whole of the lobe, pale blue.

Thorax narrow, deep black with pale blue markings as follows:—Two fine parallel lines in mid-dorsum with a small T shaped mark between them: an irregular, sinuous, humeral line and 2 broad lateral fasciæ. Occasionally the lateral blue markings are a greenish-yellow or become quickly so from post-mortem changes. The underside of the thorax and often the sides, over-laid with a white frosting which gives the black ground colour a bluish appearance.

Legs moderately large and robust, black with white frosting on the under surfaces, giving them a bluish appearance: femora 3 with an external row of numerous, very small, triangular, apicalwards directed spines: a longer spine at the distal end: femora 2 with similar spines on its basal half, then more widely separated, three terminal spines. Tibial spines long and slim: claw-hooks robust, the points not meeting.

Abdomen slim, base very slightly dilated, 3rd to 6th segments triangular on cross section and very slim, 7th to 9th a little dilated and together forming a fusiform enlargement of the abdomen. Black with blue markings as follows:—a triangular spot on the mid-dorsum of the 1st segment, a linear mark on the mid-dorsum of the 2nd, lateral spots on sides of both these segments and on the sides of the 3rd to 6th, the spots on the latter somewhat quadrilateral and followed posteriorly by a small streak of the same colour, two very large, oval, conspicuous spots on the dorsum of the 7th segment. The 8th, 9th and 10th with no markings.

Anal appendages black, as long as the 9th segment, cylindrical, pointed and curving downwards. The inferior fused, narrow, triangular and curving up to meet the superior.

Wings long and narrow, the hind a little broader than the fore: apices a little rounded: the node widely distal to the middle of wing: trigone in forewing in line with that of the hind: arc between the 2nd and 3rd antenodals: sectors of arc with very long stalks: 8th nervure (Cu. i) in the forewing out of the posterior angle of trigone, in the hind widely separated: 14 to 16 antenodal nervures: the final antenodal complete: trigone in hindwing widely distal to the arc, its costal side whole or near its distal end, obtusely broken or bent: 4th nervure (nodal sector) flat in its proximal part but bent rather sharply near the termen: only 1 row of cells between 5 and 5a: trigone in the forewing very small, the costal side very obtusely bent at its distal third: subtrigone and trigone in the forewing entire: trigone in hindwing traversed: all hypetrigones traversed: 2 cubital nervures in fore and hind-wings: only 1 row of cells in forewing: discoidal field, nearly up to the termen: 8th nervure nearly straight: discoidal field nearly parallel or a little dilated at the end: loop very indistinct, of only 4 cells and sharply limited. Stigma medium sized, nearly black, 2·5 mm. Membrane nearly obsolete, grey.

Wings are hyaline with amber coloured spurs in the inferior costal space (space between the subcostal and radius) and cubital space up to the 1st cubital nervures.

Genitals of male: 2nd segment large and prominent, with large, foliate tentaculæ (hamules).

Female: Expanse 65 mm. Length 38 mm.

A much larger insect and more stoutly built than the male. The markings are similar but much more extensive, absorbing much of the ground colour and bright lemon-yellow instead of pale blue as in the male. Blue marked specimens of the female are not uncommon. On the under surface of the abdomen, running parallel with the pleural membrane, on either side, is an additional blue or yellow stripe.

Abdomen much stouter than that of the male, laterally compressed, segments 7 to 10 dilated and the borders of the 8th and 9th with a foliate expansion.

Wings often showing considerable differences: the costal side of trigone in the forewing is not usually bent and that of the hind may or may not be bent. The loop is much more developed, the cells numbering from 6 to 7. The node lies nearer the middle of costa than it does in the male.

Genitals of female: border of 8th segment raised into a foliate-like expansion or projection, its free border arched and deeply notched. 9th ventral plate keeled.

Anal appendages much smaller than those of the male, more remote, cylindrical, straight and about as long as the 10th abdominal segment.

Habits.—This insect is not uncommon in the Nilgiris above Kalar at about 2,000′ in the months of June and July, but it is very local and unless its haunts be happed upon, it may escape notice altogether. The females are decidely more rare than the males and on account of their striking black and yellow archaic colours, they may be mistaken for Gomphinæ. They have a very weak flight and keep to the shade of heavy jungle lining mountain torrents.

THE PALMS OF BRITISH INDIA AND CEYLON, INDIGENOUS AND INTRODUCED.

BY

E. Blatter, S.J.

Part XX.

(*With Plates CIV to CVI and 7 text figures.*)

11. ***CALAMUS FLORIBUNDUS***, Griff. in Calc. Journ. Nat. Hist. V, 56; Palms Brit. Ind. 66, pl. CXCVII; Mart. Hist. Nat. Palm. III, 337; Hook. f. Fl. Brit. Ind. VI, 444; Becc. in Rec. Bot. Surv. Ind. II, 204; Ann. Roy. Bot. Gar. Calc. XI, 79, 191.—*C. mishmiensis*, Griff. in Journ. Nat. Hist. V, 55; Palms Brit. Ind. 65; Mart. Hist. Nat. Palm. III, 337.—*C. multiflorus*, Mart. in Wallich's list No. 8613 (*vide* Mart. l. c. 337, No. 506).

Climbing; stem as thick as the middle finger; sheaths densely armed with bristles and long spines, rhachis with long spines and short curved prickles. Leaflets few, inequidistant, 10-18 inches long, 1-1½ inch broad, linear-lanceolate, acuminate, uppermost crowded at the end of the rhachis and connate, margins and costæ beneath setulose; petiole and lower spathe armed with very short, stout, and long, scattered, flattened, pale spines; lower spathe 18 inches long, coriaceous, terete, mouth very oblique; spathels acuminate. Flagelli with short or long, simple or compound, recurved claws and spines, spadix elongate, where exposed plano-convex, armed on the convex face with hooked prickles; branches distant, supra-decompound, the lowermost deflexed, the upper ones ascending, the internodes concealed by spathes with truncate margins more or less ciliate, grey from whitish filamentous hairs. Branchlets which bear the spikes recurved or spreading, with short, acute, often mucronate spathes. Spikes attached midway between these, short, scarcely more than half an inch long, subscorpioid. Male flowers distichous, ovate, suffulted by a small bract which is ciliate and generally penicillate at the apex, and also by 2 bracteoles less combined than usual, sometimes nearly distinct. Calyx divided to the middle, segments half-ovate, corolla about twice the length of the calyx, divided almost nearly to the base, segments ovate-lanceolate, spreading. Stamens united to the base of corolla; filaments long, subulate, flexuose in the bud: anthers obtusely sagittate, attached above the middle, versatile. Pistillode of 3 rather small, distinct bodies. Female flowers on simply spiked, more elongate branches. Spikes 2-3 inches long, alternate, generally recurved, flexuose, pale ferruginous-tomentose. Flowers rather distant, suffulted by an amplectent bract with a short, acuminate limb, and by 2 bracteoles, of which the inner bears an incomplete disc on one side. Calyx (in bud) ovate-conical, a good deal longer than that of the male flower, divided to the middle. Corolla (in bud) length of the calyx, otherwise as in the male, but the segments have thin margins. Stamens 6, monadelphous, filaments short, flat; anthers effete. Ovary cylindrical, 3-celled, shorter than the branches of the style, which are lanceolate and papillose; ovules 3. Fruit ½ inch in diameter; scales very pale yellow, channelled down the back.

HABIT.—Upper Assam; Khasia Hills; Silhet: Mishmi Hills near Tapan Gam's village.

Found in fruit in November.

CALAMUS FLORIBUNDUS, Griff. *Var. depauperatus*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 79, 194.

DESCRIPTION.—Small, delicate, 1m high. Sheathed stem very slender, 5-6 mm. in diameter. Leaf-sheaths armed with very small short and broad spines. Ochrea densely bristly hispid. Leaves 35-40 cm. long, with 6-8 leaflets in two groups; leaflets 15-20 cm. long, 15-22 mm. broad; petiole and rhachis armed with small scattered claws. Male spadix slender, flagelliform, almost simply decompound, with 2-3 small partial inflorescences.

HABITAT.—Assam.

12. *CALAMUS KINGIANUS*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 80, 197.

DESCRIPTION.—Slender, probably scandent. Sheathed stem 10-22 mm. in diameter. Leaf-sheaths densely armed with short horizontal straight spines. Ochrea inconspicuous. Leaves with petioles about 70 cm. long, petiole 16 cm. long, armed with small solitary claws. Leaflets very few, distinctly grouped, 3-sub-5-costate, the 3 largest costæ spinulous on the upper surface, naked beneath. Male spadix elongate, simply decompound. Primary spathes narrow, very closely sheathing, entire; partial inflorescences terminating in a spikelet; side-spikelets horizontal or deflexed, 8-9 cm. long, with remote flowers.

HABITAT.—Assam.

13. *CALAMUS VIMINALIS*, Willd. Sp. Pl. II, I, 203, *var. fasciculatus*, Becc. in Hook. Fl. Brit. Ind. VI, 444; Rec. Bot. Surv. India, II, 203; Ann. Roy. Bot. Gard. Calc. XI, 81, 206.—*C. fasciculatus*, Roxb. Fl. Ind. III, 779 (*exl. cit.* Rheede); Kunth Enum. III, 208; Mart. Hist. Nat. Palm, III, 338, t. 116, f. IV; Walp. Ann. III, 488, V. 831; Griff. in Calc. Journ. Nat. Hist. V, 52; Palms Brit. Ind. 62, t. 195B. (not A), t. 190A, f. II; Miq. Fl. Ind. Bat. III., 127; Palm. Archip. Ind. 27; Kurz in Journ. As. Soc. Beng. XLIII. II. 210, t. 27, B; For. Fl. II, 517.—*C. extensus*, Mart. Hist. Nat. Palm. III. 210 (partly), t. 116, f. IV., I.—

C. pseudo-rotang, Mart. l. c. 209, t. 116, f. VI ; Griff. in Calc. Journ. Nat. Hist. V, 42 ; Palms Brit. Ind. 53 ; Kunth. Enum. III., 207—Wall. Cat. 8608, 8611.

NAMES.—English : Chair-bottom cane, rattan cane. French : rotang flexible, rotang osier. Bara Bet (Beng.), Pepa (Tel.), Kyein Ka (Burm.), Umba-vetus (Sansk.).

Stem rather stout, scrambling and climbing. Leaves 2-3 feet long ; leaflets many, 4-10 inches long, $\frac{2}{3}$-$\frac{3}{4}$ inch broad, inequidistant or fascled, 3-costate, margins and costæ beneath spinulose, pale green, rhachis and sheath white-floccose ; rhachis very stout ; petiole short, with scattered, straight $\frac{1}{2}$-1$\frac{1}{4}$ inch long, pale, hardly flattened spines ; sheath and flagelli with scattered, short, hooked spines. Spathes cariaceous, mouth obliquely truncate, flagelli with hooked 2-3-fid claws. Spadix 15 feet long, stout ; clothed with long spathes, tip flagelliferous ; branches paniculate, stout, spikes 4-5 inches long, lower spathes compressed, with subulate spines, upper prickly. Fruit small, $\frac{1}{3}$-$\frac{1}{2}$ inch in diameter, globose, beaked ; scales pale yellow, obscurely channelled down the middle.

HABITAT.—Lower Bengal, common in the village Bamboo jungles ; Orissa ; Ganjam ; Chittagong ; Mandalay ; Andaman Islands ; Penang ; Malay Peninsula ; Cochin China.

Flowers during the rains.

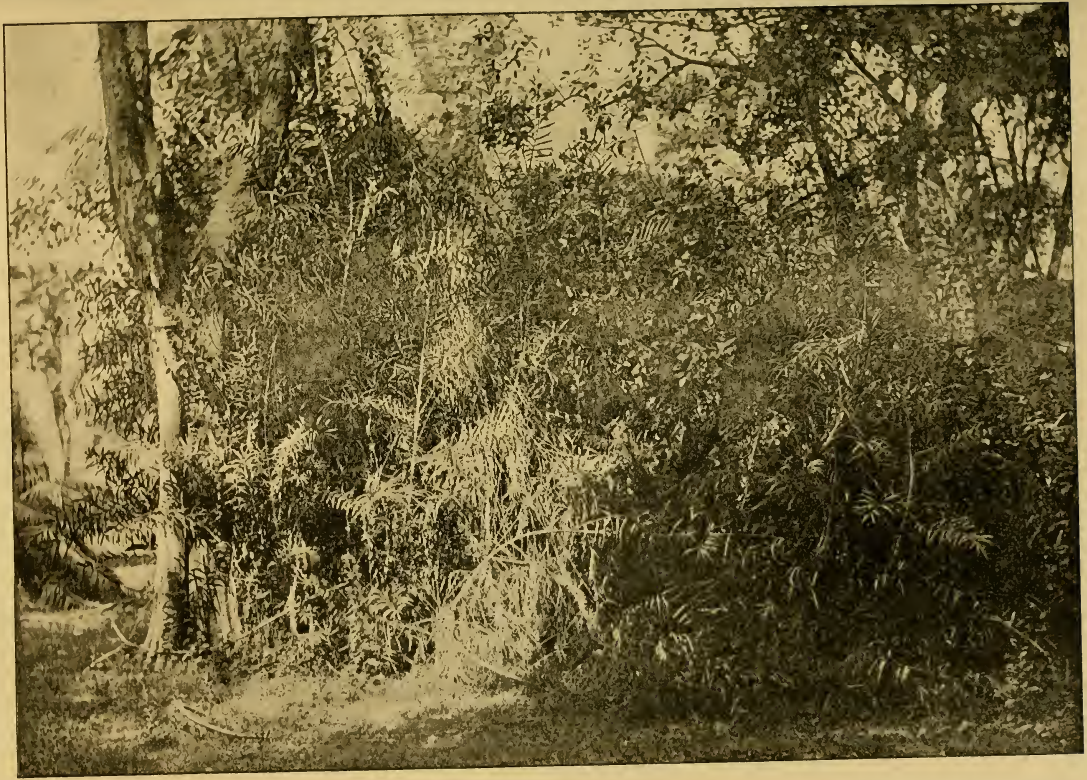
ILLUSTRATION.—Plate CIV.

14. *CALAMUS CONCINNUS,* Mart. Hist. Nat. Palm. III. 332 ; Kunth Enum, III, 207; Walp. Ann. III. 483, V. 829 ; Griff. in Calc. Journ. Nat. Hist. V. 49 ; Palms Brit. Ind. 59 ; Kurz. in Journ. As. Soc. Beng. XLIII. II, 214, t. 20. C ; Hooker, Fl. Brit. Ind. VI, 444 ; Brandis, Ind. Trees 653 ; Becc. in Rec. Bot. Surv. India II, 204, Ann. Roy. Bot. Gard. Calc. XI, 81, 210.—Wall Cat. 8607.

Climbing. Leaflets 30-50 cm. long, 2$\frac{1}{2}$-3$\frac{1}{2}$ cm. broad, many, subequidistant, linear-lanceolate, acuminate, glossy, 4-6 stout nerves on either side of midrib, margins and costæ beneath setulose, rhachis and spadix rusty-tomentose, sparingly armed with short, stout, straight, deflexed spines ; male spadix ultra-supra-recompound ; primary spathes elongate-tubular ; secondary ones infundibuliform, subscarious, loosely sheathing. Fruiting perianth explanate. Female spadix simply decompound ; spikelets 8-12 cm. long, with 18-20 distichous flowers on each side. Fruits small, globose, 8-9 mm. in diameter. Scales in 18 series, deeply channelled along the middle.

HABITAT.—Tenasserim.

15. *CALAMUS RIVALIS,* Thw. *ex* Trim. in Journ. Bot. XXIII, 268, (1885); Hooker Fl. Br. Ind. VI, 441 ; Trim. Fl. Ceyl. IV, 332 ; Becc. in Rec. Bot. Surv. Ind. II, 199 ; Ann. Roy. Bot. Gard. Calc. XI, 50, 218.



Calamus viminalis, Willd.

NAME.—Ela-wel (Singh.).

Stem slender, scandent; sheaths flagelliferous, copiously armed with straight, flat, lanceolate and subulate, pale spines, ½-1 inch long. Leaves about 3 feet long; petiole armed below with flat and above with stout recurved spines; rhachis not produced into a flagellum, scurfy, armed with short recurved spines; leaflets numerous, 12-18 inches long and ½-⅔ inch broad, equidistant, linear-lanceolate, coriaceous, margins setulose, 3-costate beneath, smooth, or midrib remotely setulose. Spadix very long, slender, armed with short recurved spines and terminated by a clawed flagellum; lower spathes or all armed with very short spines, mouth of lowest dilated, lacerate. Male spikes recurved; spathels coriaceous, very obliquely cup-shaped, acute. Male flowers distichous, crowded, about ⅙ inch long; calyx 3-fid to the middle, cupular; petals and stamens confluent in a stipes; filaments filiform; anthers oblong. Female flowers in larger spikes, not as much crowded as the males. Fruit ⅓ inch long, broadly ellipsoid with a large conical truncate beak, scales broader than long, about 10 in a vertical series, not channelled, pale yellow, bordered with red-brown.

HABITAT.—Ceylon: Moist low country, rare, Pasdun Korale, Colombo.—Endemic.

Flowers in September.

16. *CALAMUS PSEUDO-RIVALIS*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 83, 222.

VERNACULAR NAME.—Pentong (Nicobars).

DESCRIPTION.—Very probably scandent and of moderate size. Female spadix very elongate, flagelliform, the clawed flagellum reaching 2 m. Primary spathes elongate, cylindric, often longitudinally split, more or less prickly; partial inflorescences slender, about 1 m. in length, with 10-12 spikelets on each side; secondary spathes elongate, cylindric. Spikelets 8-10 cm. long, with 18-20 distichous flowers on each side. Fruiting perianth not pedicelliform. Fruit small, ovate, rounded at both ends, abruptly contracted into a cylindric 2 mm. long beak, about 1½ cm. long including the beak, about 1 cm. broad. Scales in 21 series, faintly channelled along the middle.

HABITAT.—Nicobar Islands.

17. *CALAMUS METZIANUS*, Schlecht, in *Linnaea* XXVI (1853), 727; Hook Fl. Brit. Ind. VI, 462; Becc. in Rec. Bot. Surv. Ind. II, 217, Ann. Roy. Bot. Gard. Calc. XI, 82, 221.—*C. rudentum* (*non* Lour.), Mart. Hist. Nat. Palm. III, 340.

DESCRIPTION.—Size of leaves and leaf-sheaths as in *C. rivalis*. Fruit broadly ovoid, distinctly and abruptly contracted into a beak about 3 mm. long, 17 mm. in length including the beak and perianth, 11 mm. broad. Scales channelled along the middle.

HABITAT.—Kanara.

NOTE.—This is a very doubtful species. Beccari thinks it might be a continental form of *C. rivalis.*

18. *CALAMUS PSEUDO-TENUIS*, Becc. in Fl. Brit. Ind. VI, 445 (1892); Trim. Fl. Ceyl. IV, 430; Talb. Trees Bomb. ed. 2, 345; Brandis, Ind. Trees, 652; Cooke Fl. Bomb. Pres. II, 806.—*C. tenuis,* Thw. (*non* Roxb.) Enum. 330 (*excl. syn.*).

Stem slender, extensively climbing; sheaths set with many unequal, straight, flat, very sharp spines, reaching sometimes 1 inch. Leaves about 4 feet long; petiole 8 inches long, with a few solitary short spreading spines; rhachis without flagellum, armed with scattered slender flat spines, scurfy when young; flagellum of sheath very long, slender, compressed below, thin, cylindric, and set with half rings of deflexed hooked spines; leaflets 50 or more, nearly equidistant, 8-15 inches long and $\frac{3}{4}$-1 inch broad, linear-lanceolate, acuminate, thin, with setulose margins; veins 3-5, remotely setulose on the upper surface. Male spadix with long, slender, decurved spikes; spathels funnel-shaped, acuminate. Male flowers usually 2-3 together, $\frac{1}{10}$-$\frac{1}{8}$ inch long, subglobose, calyx cupular, striate, lobes acute; petals sessile, short, polished; filaments very short. Female flowers: spadix very long, slender, branches distant, armed with short deflexed spines; spathes flattened, the lower elongate, tubular, 2-edged. Fruit ovoid, $\frac{1}{3}$-$\frac{1}{2}$ inch in diameter; beak stout, $\frac{1}{4}$ inch long, conical; scales 9-12 in a vertical row, rounded, dull yellow with brown scarious margins; endosperm subruminate; embryo basilar.

HABITAT.—Ceylon: Low country, Matale, Lady Horton's Walk. On the Western Ghats from Kanara southwards; Kanara: common in the evergreen forests at the foot of the Nilkund Ghat of N. Kanara. Madras. Cochin.

Flowers from January to April in Ceylon.

19. *CALAMUS HOOKERIANUS*, Becc. in Ann. Roy. Bot. Gard. XI, 83, 226.—*C. borneensis* (*non* Miq.), Becc. in Rec. Bot. Surv. Ind. II, 205.

DESCRIPTION.—Apparently high scandent, slender, or of moderate size. Leaflets numerous, equidistant, linear-ensiform, with 3 bristly ribs on the upper side, the largest 30 cm. long and 13 mm. broad. Female spadix very long and slender, flagelliform; primary spathes long, closely sheathing; partial inflorescences very long (up to 1$\frac{1}{2}$ m.) with many remote spikelets on each side; spikelets filiform, rigid, zigzag sinuous, with the flowers rather remote and pushed downwards by the very conspicuous axillary callus. Fruiting perianth callous at the base.

HABITAT.—Probably Coromandel Coast.

20. *CALAMUS DELICATULUS*, Thw. Enum. 330, 431 (1864); Hooker Fl. Brit. Ind. VI, 446; Trim. Fl. Ceyl. IV, 332; Becc. in Rec. Bot. Surv. Ind. II, 206; Annals Roy. Bot. Gard. Calc. XI, 86, 246.

NAME.—Nara-wel (Singh.).

Stem slender, scandent; internodes with a tuft of erect, white, hair-like prickles 1-2½ inch long below the nodes, sheaths flagelliferous, sparsely scurfy, beset with many, spreading, flattened, white, short and long linear spines up to 4-5 inches long. Leaves 2-3 feet long; petiole of lower 2 feet, of upper very short, both furnished with a few hooked spines; rhachis not produced into a flagellum, scurfy, and with a few straight spines; leaflets many, equidistant, close-set, 8-10 inches long and ½ inch broad, linear-lanceolate, finely acuminate or acute, and hair-pointed, 3-veined, margins and veins on both surfaces with a few long black bristles. Spathes tubular, truncate, unarmed, mouth ciliate; spathels tubular, imbricate, truncate; spathellules cupular, minute. Spadix polygamo-dioecious, very long, filiform, decompound, beset with small hooked spines; flowering branches about 18, 1-5 inches long; spikes very slender. Male flowers rather distant, about ⅛ inch long; calyx urceolate, 5-toothed; petals twice as long, oblong, acute, bases connate; filaments rather long. Female flowers: petals hardly longer than the calyx; ovary oblong, seated in a 6-toothed cup. Fruit (immature?) subglobose, ½ inch in diameter, beak conical, not long; scales about 8 in a vertical series, ochraceous, with a very dark brown border, centre not channelled.

HABITAT.—Ceylon: Moist country below 1,000 feet, rather rare, Galle, Hiniduma, Pasdum Korale.—Endemic.

Flowers from December to May.

21. *CALAMUS HELFERIANUS*, Kurz in Journ. As. Soc. Beng. XLIII, II, 213; For. Fl. II, 521; Hook. f. Fl. Brit. Ind. VI, 446; Becc. in Rec. Bot. Surv. Ind. II, 206; Ann. Roy. Bot. Gard. Calc. XI, 87, 247.

DESCRIPTION.—Stem slender, scandent. Leaves without flagelli; leaflets many, scattered, inequidistant in series of 2-8 on a side, narrowly linear, finely acuminate, 8-12 inches long, ½-⅔ inch broad, uppermost quite free, costæ 3-5, strong beneath, margins and lateral costæ above and median beneath setulose; rhachis slender, trigonous, armed with short scattered recurved spines, with naked intervals sometimes 4 inches long. Spadix several feet long, very slender, flexuous, as thick as a sparrow-quill, compound, upper spikes simple, lower panicled, males shorter and more slender. Lower spathe long, narrow, compressed, with a short erect limb and short spines on the keels, partial $1\frac{1}{2}$-1 inch long; spathellules of male flowers very short and crowded, of female $\frac{1}{6}$ inch long. Male flowers $\frac{1}{8}$-$\frac{1}{6}$ inch long, calyx 3-fid.

HABITAT.—Tenasserim (or the Andaman Islands?).

22. *CALAMUS NICOBARICUS*, Becc. in Hook. Fl. Br. Ind. VI, 446; Brandis Ind. Trees 654; Becc. in Rec. Bot. Surv. Ind. II, 206, Ann. Roy. Bot. Gard. Calc. XI, 87, 249.

VERNACULAR NAME.—Tchye (Nicobars).

A very slender plant, with varnished internodes, $\frac{1}{6}$-$\frac{1}{4}$ inch in diameter. Leaflets very many, 7-$8\frac{1}{2}$ inches long, about $\frac{1}{4}$ inch broad, equidistant, linear-ensiform, long-acuminate, sparsely setose on the median costa only on both surfaces, shining above, lateral costal slender, naked; petiole channelled above, armed with long, straight, marginal spines and short claws on the back, sheath very pale, at first scurfy, densely armed with very unequal, long, flat spines and short claws. Flagelli exceedingly slender. Spadix and fruit unknown.

In Beccari's opinion this species seems to be allied to *C. delicatulus*, from which it is distinguished by the leaflets being setose only on the median costa.

HABITAT.—Nicobar Islands.

USES.—It is much used by the natives and is in great demand by ship-traders who take it to the Straits (*ex* Beccari).

23. *CALAMUS TENUIS*, Roxb. Fl. Ind. III, 780; Kunth Enum. III, 211; Mart. Hist. Nat. Palm. III, 335; Griff. in Calc. Journ. Nat. Hist. V, 46; Palms Brit. Ind. 57, t. 193 A, B, C; Walp. Ann. III, 485, V, 830 Miq. Fl. Ind. Bat. III, 118; Kurz in Journ. As. Soc. Beng. XLIII, II, 212, t. 31 B; For. Fl. II, 520; Hooker, Fl. Brit. Ind. VI, 447; Brandis, Ind. Trees 652; Becc. in Rec. Bot. Surv. Ind. II, 206; Ann. Roy. Bot. Gard. Calc. XI, 89, 262—*C. royleanus*, Griff. ll. cc. 40 and 53, t. 191; Mart. l. c. 335; Walp. ll. cc. 485 and 830—*C. amarus*, Lour. I, 210?—*C. heliotropium*, Ham.; Mart. l. c. 334; Kunth. l. c. 210; Griff. ll. cc. 51 and 61; Walp. ll. cc. 484 and 830.—*C. rotang*, Brandis, For. Fl. 559.

NAMES.—Bet, Bent (Hind.), Jatee Bhet (Assam), May dan (Cochin China).

Stems very long, slender, scandent; internodes not thicker than a goose-quill. Leaves oblong, equally pinnate, $1\frac{1}{2}$-2 feet long; leaflets very many, from 20-30 on each side, equidistant, alternate, linear, polished, the lower 8-12 inches long, $\frac{1}{3}$-$\frac{1}{2}$ inch broad, margins minutely setulose or spinulose, bristles on the nerves $\frac{1}{4}$ inch long. Petiole pale, stout, short, margined with straight spines; rhachis armed with one row of short, recurved spines; flagelli filiform, sheaths flagelliferous, sparingly armed with short, flat spines. Spadix very long, decompound, flagelliferous; primary branches

4-6, remote, flexuose, with about half a dozen alternate, recurved branches on each side. Spathes elongate, tubular, lower 6-10 inches with a short limb and scattered, recurved spines, partial ones short, unarmed, scurfy when young, spathellules densely crowded, cymbiform. Flowers very small; male flowers $\frac{1}{10}$ inch long, not distichous and spreading but secund in 3-4 series, imbricating, suberect. Fruit $\frac{1}{2}$ inch in diameter, subglobose, mucronate; scales pale with a shallow median channel and very narrow discoloured margins. (Fig. 1.)

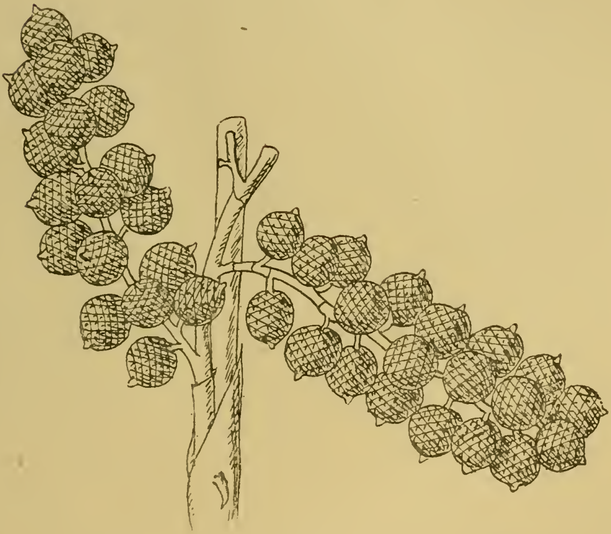


FIG. 1—*Calamus tenuis*. Some branches of a fruiting spadix.

HABITAT.—Tropical Himalaya, from Kumaon eastwards, Bengal, Assam, Silhet, Chittagong and Burma.—Cochin China.

USES.—The rotang of this species is much used for domestic work.

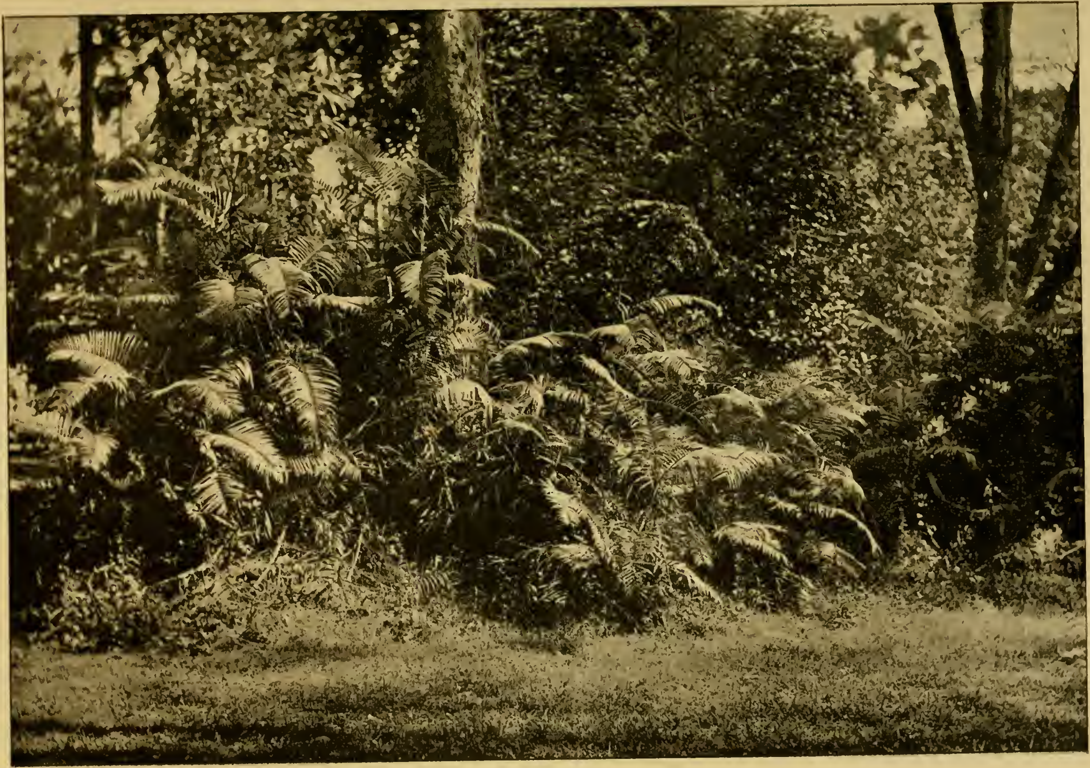
24. *CALAMUS ROTANG*, L. Sp. Pl. ed. 2,463 (*Planta Ceylonensis tantum et excl. syn.* Hort. Malab. et Herb. Amboin.); Roxb. Fl. Ind. III, 777; Mart. Hist. Nat. Palm. III, 334, t. 116, f. 8, and t. ZXXII, f. XII; Bl. Rumphia III, 33; Miq. Fl. Ind. Bat. III, 117; Gamble Man. Ind. Timb. 423; Hook. f. Fl. Brit. Ind. VI, 447; Becc. in Rec. Bot. Surv. Ind. II, 206, Ann. Roy. Bot. Gard. Calc. XI, 90, 269.—*C. Roxburghii*, Griff. in Calc. Journ. Nat. Hist. V, 43; Palms Brit. Ind. 55, t. CXCV A (Sub *C. fasciculatus*) and t. CXCII (CXII *per errorem*); Thw. Enum. Pl. Zeyl. 330.—*C. monoecus*, Roxb. Hort. Beng. 73 *ex* Ind. Kew. Suppl. I.—*C. monoicus*, Roxb. Fl. Ind. III, 783; Mart. Hist. Nat. Palm. III, 334 (*excl. descrip.* Wallichii no. 8604?); Griff. in Calc. Journ. Nat. Hist. V, 48; Palms Brit. Ind. 58.—*C. scipionum*, Lam. (*partim*) Encycl. Bot. 304 (*excl. syn.* Lour. *et* Rheede).—*Arundo Rotang Zeylanica spinosissima*, etc., J. Burm. Thes. Zeyl. 36; Linn. Fl. Zeyl. 209, 468; Herm. Mus. Zeyl. 59.—*Arundo nucifera Rotang dicta*, etc. Pluk. Almag. 53 (*excl. syn.* Clusii).—*Phoenicoscorpiurus s. Heliotropium Palmites spinosum*, Pluk. Phytogr. 5,106. f. (*excl. Marcg.*).—*Arundo Rotang dicta*, Pison. Ind. Orient. Mant. 188.—*Arundo indica versicolor flexilis*, C. Bauh. Pin. 18, IV; J. Bauh. Hist. Pl. II, 489; Raj. Hist. Plant. II, 1277.

NAMES.

English: Cane, chair-bottom cane, common rattan cane, rotang.
French: Canne de Bengale, jonc de l'Inde, ratin, rotang ordinaire, rotin, rottain.
German: Palmriet, Rattangpalme, Rotang, Rottang, Rotting, Spanisches Rohr, Steinrottang, Stuhlrohr.
Dutch: Rotting, rottinggewas, rottingriet ruut, ruutstek, spaansch riet.

Perambu, Priampu (Tam.); Wewel (Singh.); Betamu, Bettapu, Niru Prabba, Pemu, Pepu (Tel.); Bet, Beta, Chachi Bet (Beng. and Hind.); Pepa, Prabba (Central Prov.); Rotan (Malay.); Bed (Pers.).

DESCRIPTION.—Stem very slender, scandent; sheaths flagelliferous, sparingly armed with short flat spines. Leaves $1\frac{1}{2}$-2 feet long, petiole very short, stout margined with small straight or recurved spines with conical laterally compressed bases; leaflets very many, equidistant, lower 8-12 inches long and $\frac{1}{3}$-$\frac{1}{2}$ inch broad, upper gradually smaller, linear-lanceolate acuminate, 3-veined, veins naked above or bearing distant bristles sometimes $\frac{1}{4}$ inch long, midrib alone setose beneath, margins setulose. Male spadix very long, decompound, flagelliferous, sparingly spinous; spathes elongate, tubular, lower 6-10 by nearly $\frac{2}{3}$ inch diameter, sparingly armed with scattered recurved spines, upper unarmed, scurfy; spikes 1-$1\frac{1}{2}$ inch, recurved or revolute, bracteoles densely crowded, cymbiform. Male flowers secund in 3-4 series, $\frac{1}{8}$ inch long; calyx cupular, base thickened, striate lobes broad, acute; petals sessile, smooth, acute; filaments very short, subulate. Female flowers $\frac{1}{10}$ inch long, scattered along the slender branches of the spadix; calyx conical, tubular, 3-toothed, base dilated, truncate;



RATTAN (*Calamus Rotang*, L.).

petals sessile, tips only exserted. Fruit seated on the minute perianth, subglobose, ½ inch in diameter, mucronate, scales many in a vertical series, pale yellow with a very narrow thin discoloured margin and shallow median channel. (Fig. 2.)

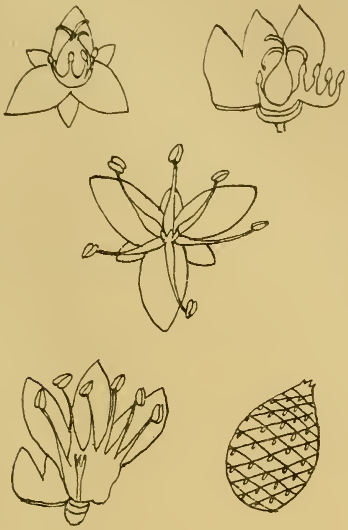


FIG. 2—Flowers and fruit of *Calamus rotang* L. (After Griffith).

HABITAT.—Central Provinces, the Deccan, Carnatik, Ceylon, (not in Bengal).

FLOWERS.—In February and March.

USES.—*Calamus rotang*, and various other long trailing species, yield the common rattan of commerce, which, though apparently insignificant, form a considerable article of export. When fresh gathered, the stems are covered with green sheaths, but are divested of them while yet in a green state, and then dried. They are extensively used as props for plants, as well as for cables, ropes, wicker-work, baskets, chairs, and couches; being very strong, and at the same time flexible, they are admirably adapted for those purposes. Cordage and cables for vessels are sometimes made from the stems twisted together. In fact, their strength is exceedingly great when several are twisted in this way, and will answer all the purposes of the strongest cables. Rattans are occasionally used in

India for bridges. Hooker gives a description of such a cane-bridge in his "Himalayan Journals" where he says: "Soon afterwards (after crossing the Rungmo), at a most wild and beautiful spot, I saw, for the first time, one of the most characteristic of Himalayan objects of art, a cane-bridge. All the spurs, round the bases of which the river flowed, were steep and rocky, their flanks clothed with the richest tropical forest, their crests tipped with pines. On the river's edge, the Banana, Pandanus and Bauhinia, were frequent, and Figs prevailed. One of the latter projected over the stream, growing out of a mass of rock, its roots interlaced and grasping at every available support, while its branches, loaded with deep glossy foliage, hung over the water. This tree formed one pier for the canes; that on the opposite bank was constructed of strong piles, propped with large stones, and between them swung the bridge, about eighty yards long, ever rocking over the torrent. The lightness and extreme simplicity of its structure were very remarkable. Two parallel canes, on the same horizontal plane, were stretched across the stream; from them others hung in loops, and along the loops were laid one or two bamboo stems for flooring; cross pieces below this flooring, hung from the two upper canes, which they thus served to keep apart. The traveller grasps one of the canes in either hand, and walks along the loose bamboos laid on the swinging loops; the motion is great, and the rattling of the loose dry bamboos is neither a musical sound nor one calculated to inspire confidence."—In Europe rattans are extensively used for caning chairs, for making brooms, and, when dyed black, as a substitute for whalebone, for umbrella-ribs, and for stiffening bonnets. In Japan all sorts of basket-work are made of split cane, and even cabinets with drawers. Cane is also plaited and twisted into cordage, and slender fibres are made to answer the purpose of twine. In Java the cane is cut into fine slips, which are plaited into excellent mats or made into strong, and at the same time neat, baskets. Bennet says in his "Wanderings" that near Macao the rattans are split longitudinally, soaked, and attached to a wheel, which one person keeps in motion, whilst another binds the split rattans together, adding others to the length from a quantity carried around his waist, until the required length of the rope is completed.

CULTIVATION.—When young *Calamus rotang* is a very graceful plant, but when it attains a height of 5-6 feet and develops its whip-like flagella armed with numerous sharp recurved thorns it is generally considered time to cut it down. (Woodrow.)

ILLUSTRATION.—Plate CV.

25. *CALAMUS DELESSERTIANUS*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 91, 276.

DESCRIPTION.—Probably scandent and of moderate size. Leaflets numerous rather closely set and equidistant, elongate-ensiform, sub-5-costulate, the intermediate ones 32-35 cm. long and 20-22 mm. broad, the 3 main ribs furnished with bulbous bristles on the upper surface, underneath the mid-rib alone bristly; the margins closely spinulous. Female spadix apparently large and elongate; upper primary spathes elongate, cylindric; partial inflorescences with about 13 distichous spikelets on each side; spikelets inserted just at the mouth of their respective spathes with a distinct axillary callus, the lower ones about 6 cm. long with 20 flowers on each side; involucrophorum not pedicellate. Female flowers 3 mm. long; neuter flowers more slender, but as long as the female ones, their corolla twice as long as the calyx.

HABITAT.—Probably S. India.

26. *CALAMUS BRANDISII*, Becc. in Hook. Fl. Brit. Ind. VI, 448; Rec. Bot. Surv. Ind. II, 206; Ann. Roy. Bot. Gard. Calc. XI, 91, 278; Brandis Ind. Trees 651.

Stem slender; leaflets few, fascicled, lanceolate, ensiform, naked beneath, sparsely setose above on the 3 costæ; petiole slender with few very long, slender, straight spines, rhachis with long, stout, solitary, straight and recurved spines; sheath armed with solitary or aggregate, slender, flattened, straight spines, mouth with very long; needle-shaped spinules. Male spadix elongate, shortly flagelliferous, with few partial inflorescences; spathes narrow tubular, upper funnel-shaped, unarmed, embracing the bases of the spikelets; flowers 4-seriate in bud.

HABITAT.—Travancore, near Courtallam, 3-5,000 feet.

27. *CALAMUS ACANTHOSPATHUS*, Griff. in Calc. Journ. Nat. Hist. V, 39; Palms Brit. Ind. 50, t. 190 B. (not A, f. 1); Mart. Hist. Nat. Palm. III, 333, t. 176, f. VI; Walp. Ann. III, 484, V, 830; Hook. Fl. Brit. Ind. VI, 448; Becc. in Rec. Bot. Surv. Ind. II, 206; Ann. Roy. Bot. Gard. Calc. XI, 92, 283; Brandis Ind. Trees 651.—*C. montanus*, T. Anders. in Journ. Linn. Soc. XI, 9; Gamble Man. Ind. Timb. 242.

NAMES.—Gouri Bet. (Nep.); Rue, Rhu (Lepchas).

Stems slender, scandent, as thick as a swan's quill, forming dense thickets. Leaves 2-3 feet long; leaflets few, large, 10-16 inches long, 2-3 inches broad, inequidistant, elliptic-lanceolate, strongly 5-7-costate, margins naked or spinulose, both surfaces quite naked or very rarely with a few small spines on the costæ of the upper surface; rhachis and long petiole very stout, scurfy, armed with 2-3 series of very stout, recurved spines; sheath stout, densely armed with long, flattened and short, stout, straight or recurved spines; flagellum of the sheath 10-12 feet long. Spadix 4-6 feet, erect, very stout, flagelliferous; peduncle short, compressed, armed on the edges and lower face with unequal, straight, subulate spines and prickles, those of the edges being the longest. Spathes with obsolete limbs, the lowest about 1 foot long, compressed, keeled along the centre of the back and, excepting the short, erect, half-lanceolate limb, armed with straight prickles having conical bases. The other spathes are shorter, more clavate, without an obvious keel and only slightly armed, or as the uppermost, quite unarmed. Branches of fruiting spadix very stout; spikes 1-4 inches long, strongly recurved. Fruit obovoid or globose, $\frac{2}{3}$ inch in diameter, shortly beaked; pericarp thin; scales chestnut brown, obscurely channelled, shining; fruiting calyx large, cupular, $\frac{1}{6}$ inch in diameter, lobes very short. Seed deeply pitted. (Fig. 3).

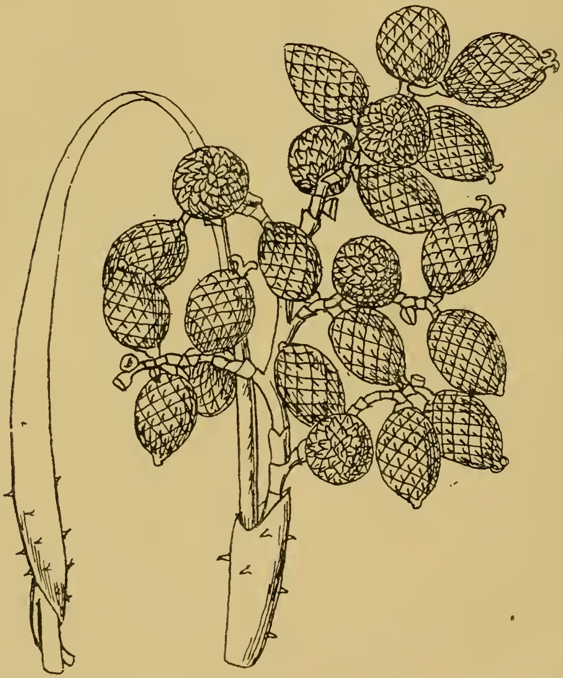


FIG. 3.—Branch of fruiting spadix with part of flagellum of *Calamus acanthospathus*. (After Griffith.)

HABITAT.—Eastern Nepal; Sikkim and Bhotan, Himalaya, 3-6,000 feet; Khasia Hills, 2-4,000 feet.

28. *CALAMUS FEANUS*, Becc. in Hook. F. Fl. Brit. Ind. VI, 448, Rec. Bot. Surv. Ind. II, 206, Ann. Roy. Bot. Gard. Calc. XI, 92, 286.

DESCRIPTION.—Stem scandent; internodes $\frac{1}{3}$-$\frac{1}{2}$ inch in diameter. Leaves rather short, about 3 feet 3 inches long; ochrea very short, truncate; leaflets few, 6-8, remote, subequidistant, the larger 8-12 inches long, 2-2$\frac{3}{4}$ inches broad, elliptic-lanceolate or oblanceolate, 7-9-costate, the terminal one free; petiole very short and rhachis armed with short hooked spines, sheath $\frac{1}{2}$-$\frac{2}{3}$ inch long, flagelliferous, cariaceous, green, marbled with black scurfy spots, strongly armed with scattered long spreading or deflexed and short stout reflexed spines. Male spadix 1$\frac{1}{2}$ inch long, decompound, erect, rigid, with 7 partial inflorescences; lower spathe tubular, 2-keeled, mouth compressed; keels armed with short stout spines; upper spathe obliquely truncate; spikelets recurved. Fruit broadly ovoid, about $\frac{1}{3}$ inch by $\frac{1}{4}$ inch in diameter; beak conical, acute; scales about 15-seriate, not channelled on the back, where they are opaque and as if pulverulent with a broad rather discoloured band. Seed deeply pitted.

HABITAT.—Tenasserim, 3-5,000 feet high.

29. *CALAMUS GURAUB*, Ham., in Mart. Hist. Nat. Palm. III, 206 and 330, t. 175, f. 1; Griff. in Calc. Journ. Nat. Hist. V, 42; Palms Brit. Ind. 54; Kunth Enum. III, 210; Kurz in Journ. As. Soc. Beng. XLIII, II, 214; For. Fl. II, 522; Becc. in Hook. Fl. Brit. Ind. VI, 449, Rec. Bot. Surv. Ind. II, 207, Ann. Roy. Bot. Gard. Calc. XI, 93, 299.—*C. mastersianus*, Griff. ll. cc. 76 and 84, t. 206; *Daemonorops guruba* var. *Hamiltonianus et* var. *Mastersianus*, Mart. ll. cc.; Walp. ll. cc. 479 and 828; Miq. Fl. Ind. Bat. III, 100.

NAMES.—Sundi Bet, Onabi Bhet, Quabi Bet.(Ass.); Kyeinn Kyeingnee (Burm.)

DESCRIPTION.—Tall, climbing; stem with the sheaths about inch in diameter. Leaves 5-6 feet long; leaflets 12-15 inches long, $\frac{1}{2}$-$\frac{2}{3}$ inch broad, alternate, equidistant, narrowly linear, margins and 3 costæ above setose, midrib usually alone setose beneath, the long slender petiole and rhachis armed with long, brown, recurved and short, conical spines below and on the margins. Sheaths flagelliferous, covered with long flattened spines and crowded smaller ones; ligule long, membranous (coriaceous, Griffith). lacerate. Spathes glabrous, tube of lower compressed, margins with long spines, back with short ones, limb recurved; upper spathes nearly unarmed; flagellum very stout and stoutly armed. Male spadix elongate, very slender, decompound, spikes 2-3 inches long, very slender, flexuous, spreading, spathellules very small and shallow. Flowers distichous, pointing forwards, nch long; calyx striate corolla twice as long, polished. Fruit pisiform, $\frac{1}{4}$ inch in diameter, abruptly beaked ; scales very pale, obscurely channelled, margin brown.

HABITAT.—Bengal, Assam, the Khasia Hills, Silhet, Chittagong, Burma.

FLOWERS.—In April.

30. *C. NITIDUS*, **Mart. Hist. Nat. Palm. III, 334 ; Kunth Enum. III, 211 ; Griff. in Calc. Journ. Nat. Hist., V. 49 ; Palms Brit. Ind. 59 ; Miq. Fl. Ind. Bat. III, 117 ; Walp. Ann. III, 484, V, 830 ; Wall. Cat. 8609 ; Hooker, Fl. Brit. Ind. VI., 449 ; Brandis Ind. Trees 652 ; Becc. in Ann. Roy. Bot. Gard. Calc. XI, 94,302.**

DESCRIPTION.—Probably scandent and slender. Leaves 60-70 cm. long. Leaflets equidistant, rigidulous close-set, 15-18 cm. long, linear-lanceolate, acuminate, shining, margins thickened, costæ 3, setulose on both surfaces or on the upper only ; rhachis with simple or compound recurved spines.

Male and female spadices very slender with many partial inflorescences and a very slender flagellum at their summit ; primary spathes open and flat during the anthesis, broadly linear, somewhat longer than the inflorescences. Fruiting perianth shortly pedicelliform. Fruit very small.

HABITAT.— Tavoy in Tenasserim.

31. *C. PLATYSPATHUS*, **Mart. Hist. Nat. Palm. III, 210 ; Griff. in Calc. Journ. Nat. Hist. V, 75 ; Palms Brit. Ind. 83 ; Kurz in Journ. As. Soc. Beng. XL., 214 ; Hooker Fl. Brit. Ind. VI., 449 ; Becc. in Rec. Bot. Surv. Ind. II, 207, Ann. Roy. Bot. Gard. Calc. XI, 94, 304. *Daemonorops plathyspathus*, Mart. l. c. ed. 2, 206, 329 ; Miq. Fl. Ind. Bat. III., 99 ; Walp. Ann. III, 479, V., 828.**

DESCRIPTION.—Leaflets few, 10-12 inches long, 1-1$\frac{1}{4}$ inch broad, scattered, alternate, ensiform, acuminate, 5-7-costate, rigid, margins bristly towards the apex, young pale, softly scurfy beneath, margins thickened with obscure distant asperities ; rhachis armed with straight and recurved, strong, solitary and binate spines with swollen bases, sheath armed with close-set, straight, subulate spines. Male spadix long, very slender, sparsely shortly armed, inflorescences short, 3-4 inches long, subsessile, paniculately branched; spikelets very short, $\frac{1}{4}$-$\frac{1}{2}$ inch long, few-flowered. Upper spathes with very short sheaths and flat, linear-oblong, laminæ, 3-4 inches long, $\frac{1}{3}$-$\frac{2}{3}$ inch broad ; spathellules very short, acute. Male flowers $\frac{1}{10}$ inch long, pale, close-set, pointing forwards ; calyx sharply toothed, striate ; corolla twice as long as the calyx, not striate.

HABITAT.—Tenasserim : Tavoy.

32. *C. MYRIANTHUS*, **Becc. in Hook. Fl. Brit. Ind. VI, 451 ; Rec. Bot. Surv. Ind. II, 207 ; Ann. Roy. Bot. Gard. Calc. XI, 94, 306 ; Brandis, Ind. Trees, 653.**

DESCRIPTION.—Apparently scandent and of moderate size

Leaflets very long, narrowly elliptic-lanceolate, many-costate, pale, almost white beneath, smooth on both surfaces or with minute bristles on the costæ beneath, margin obscurely aculeolate; rhachis dorsally rounded, shortly spinous. Male spadix very long, slender, sparsely spinous, spathels tubular, truncate. Inflorescences laxly decompound; branches very slender; spike $\frac{1}{4}$-$\frac{1}{2}$ inch long, zigzag, almost filiform; spathellules minute. Flowers minute, pointing forward, closely imbricate, calyx acutely 3-lobed, striate; corolla twice as long, acute, not striate.

Habitat.—Tenasserim: Mergui.

33. *C. HYPOLEUCUS*, Kurz. For. Fl. II, 523, *excl. descr. spad. masc*; Hook Fl. Brit. Ind. VI. 451; Brandis, Ind. Trees 653; Becc. in Rec. Bot. Surv. Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 94, 307. *Daemonorops hypoleucus*, Kurz. in Journ. As. Soc. Beng. XLIII, III, 208 (*partim*), t. XVIII. (*excl.* t. XIX.).

Description.—Stem slender, scandent, as thick as a goose-quill without the sheaths. Leaves 2-3 feet long, not flagelliferous; sheaths flagelliferous; leaflets 6-9 inches long, alternately and interruptedly approximate by twoes on each side, oblong-lanceolate, acuminate, ciliate towards the apex, many-costate, white beneath; petiole short, armed with long and short conical, straight and recurved spines; rhachis with scattered recurved spines; sheaths densely spiny with unequal spines 1 inch long and less. Female spadix 12 inches long; peduncle about 1 inch long, spinous; spathes oblong-lanceolate, spathels tubular, small, distant. Female flowers distichous; calyx $\frac{1}{24}$ inch long, shortly 3-lobed; corolla twice as long, segments acute.

Habitat.—Burma; Thoungyeen.

34. *CALAMUS LEUCOTES*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 95, 309.—*C. hypoleucus*, Kurz Fl. Brit. Burm., II, 523 (*quoad spadic. masc. tantum*).—*Dæmonorops hypoleucus*, Kurz in Journ. As. Soc. Beng. XLIII, ii (*quoad tab.* XIX. *tantum*).

Description.—Probably scandent. Sheathed Stem 2 cm. in diameter. Leaf sheaths very densely armed with very unequal, small and large, ascendent spines. Ochrea short. Leaves rather robust and large; petiole robust and long. Leaflets few, grouped, with very long vacant spaces interposed, firmly papyraceous, lanceolate or elliptic-lanceolate, up to 40 cm. long and 5·5 cm. broad, plicate, many-costate, green above, covered with a crustaceous chalky coating beneath. Male spathe elongate, rigid, with a robust axis. Partial inflorescences strict, cupressiform, much shorter than the primary spathes; primary spathes elongate, open, flat. Male flowers 3 mm. long, acute.

Habitat.—Burma: Yoonzuleen.

35. *C. TRAVANCORICUS*, Bedd. mss. in Herb. Kew.; Hook, Fl. Brit. Ind. VI, 452; Brandis, Ind. Trees 653; Becc. in Rec. Bot. Surv.

Ind. II, 207 : Ann. Roy. Bot. Gard. Calc. XI, 95, 310; Rleede Hort. Mal. XII, t. 64.—*C. gracilis* (*non* Roxb.) Griff. Palms Brit. Ind. 64 (*quoad tab. Rheedeanam tantum*).

NAME.—Tsjeru tsjurel (Mal.).

DESCRIPTION.—Stem very slender, scandent. Leaves 18-24 inches long; leaflets 4-6 inches long, ½-⅔ inch broad, broadest about or above the middle and thence tapering to a capillary point, in distant opposite groups of 3-5, narrowly oblanceolate, thin; costæ 3, very slender, naked above, sparsely setulose beneath; rhachis and petiole very slender, armed with small straight and recurved spines; sheath armed with slender, straight, flattened prickles; petiole 4-6 inches long, dorsally rounded, margins acute, much compressed towards the base and there chiefly spiny. Spadix 2-3 feet long, slender, flagelliferous; peduncle short, flattened, young white scurfy, margins shortly spiny. Inflorescences about 2 inches long, shorter than the membranous flat spathes, male decompound with spreading very slender branches bearing short, flexuous, almost capillary spikes of flowers ⅛ inch long; female inflorescence with simple, distichous, recurved spikes and rather larger flowers. Lower spathes tubular, compressed at the base, with shortly spinous angles, produced into a long, membranous, sheathing lamina; upper spathes and spathels tubular, obliquely truncate, spathellules short, acute, calyx strongly striate; corolla twice as long as the calyx, not striate.

HABITAT.—Deccan Peninsula; from Malabar to Travancore.

36. *C. RHEEDEI*, Griff. in Calc. Journ. Nat. Hist. V, 73; Palms Brit. Ind. 36, 83; Hook. Fl. Brit. Ind. VI, 452; Brandis Ind. Trees 653; Becc. in Rec. Bot. Surv. Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 95, 313.—*Daemonorops rheedii*, Mart. Hist. Nat. Palm. III, 330; Miq. Fl. Ind. Bat. III, 100; Walp. Ann. III, 479, V, 828; Rheede Hort. Mal. XII, t. 65.

NAME.—Katu tsjurel (Mal.).

DESCRIPTION.—Leaflets in very distant groups of 3 on a long rhachis armed with scattered, short, recurved spines, linear-lanceolate, acuminate. Fruiting spadix with the flat open acute spathes longer than the ovoid dense clusters of ellipsoid or oblong fruits.

This plant is only known from Rheede's plate and has never been described from living or dried specimens.

HABITAT.—Malabar.

USES.—The seed of this Calamus dried and powdered '*genuum ulcera sanat*' (Rheede).

37. *C. HUEGELIANUS*, Mart. Hist. Nat. Palm. III, 338; Walp. Ann. III, 488, V, 831; Hook. Fl. Brit. Ind. VI, 452; Brandis Ind. Trees 652; Becc. in Rec. Bot. Surv. Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 100. 314.—*C. wightii*, Griff. Palms Brit. Ind. 102, t. 216 C.—*C. melanolepis*, H, Wendl. in Kerch. Palm. 237.—*Daemonorops melanolepis*, Mart. Hist. Nat. Palm. III, 331, t. 175, f. XI; 342 under *C. dioicus* and t. 116, f. XI; Walp. . cc. 481 and 829.

Description.—Leaflets many, equidistant, 12-16 inches long, ⅔-1 inch broad, elongate, ensiform, acuminate, strongly 3-costate, margins smooth, unarmed above, beneath pale and with a very few long bristles on the lateral costæ, the very distant bristles on the lateral nerves beneath sometimes absent, at others nearly ½ inch long; petiole stout, scurfy when young, back rounded with very stout, short, recurved spines; rhachis pale; sheath armed with very stout scattered long and short spines. Female spadix stout, erect; spathes sparingly armed with stout claws, narrowly tubular, truncate. Fruiting branches 6-10 inches long, very stout, spikes recurved, calyx pedicelled, cupular, with spreading lobes. Fruit globose, ⅔-¾ inch in diameter, very shortly beaked, black shining; scales subacute, with fimbriate margins, not channelled.

Habitat.—Nilghiri Hills, 5-6,000 feet high: Sisparah, Naduvatam.

38. *CALAMUS GAMBLEI*, Becc. in Hook. f. Fl. Brit. Ind. VI, 493; Rec. Bot. Surv. Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 96, 316.

Description.—Probably scandent and of moderate size. Leaves large. Leaflets 6-7 cm. apart, ensiform, 60-65 cm. long, 25-28 mm. broad, with three on both surfaces more or less bristly-spinulous costæ, margins remotely ciliate-spinulous. Female spadix with somewhat arched, 25-30 cm. long, partial inflorescences. Spikelets arched, sub-scorpioid. Female flowers pointing upwards, ovate, 5 mm. long. Fruit globose-obpyriform or turbinate-globose, tapering towards the base, 22-25 mm. long, 17-18 mm. broad. Scales usually in 21 series, pale yellow, shining, strongly gibbous, distinctly channelled. Seed globose, ovoid.

Habitat.—Nilghiris in the Makurti forest at about 5,000 ft.

CALAMUS GAMBLEI, Becc. var. *sphaerocarpus*, Becc. l. c.

Description.—Fruit spherical, not tapering to the base, 18 mm. in diameter. Seed almost spherical.

Habitat.—Nilghiris.

39. *C. GRACILIS*, Roxb. (*non* Blanco *neque* Thw.) Fl. Ind. III, 781 (*excl. Syn.* Hort. Mal. XII, t. 64;) Mart. Hist. Nat. Palm. III, 338; Kunth Enum. III, 209; Griff. in Calc. Journ. Nat. Hist. V, 54; Palms Brit. Ind. 64, t. 196; Walp. Ann. III, 488, V, 831; Kurz in Journ. As. Soc. Beng. XLIII, II, 212, t. 31 C; For. Fl. II, 520; Hook. Fl. Brit. Ind. VI, 453; Brandis Ind. Trees 653; Becc. in Rec. Bot. Surv. Ind. II, 208; Ann. Roy. Bot. Gard. Calc. XI, 96, 318.

Name.—Mapuri Bet (Beng.); Oahing Bet (Assam).

Description.—Slender, climbing to a great extent; naked stem not thicker than a quill; all the younger parts included towards their extremities in the armed sheaths of the leaves and then being about as thick as a man's little finger. Leaves 2-3 feet long, alternate, recurved; leaflets 5-7 inches long, collected in opposite groups of 3-5 on each side of the slender rhachis, elliptic-lanceolate, acuminate, 3-7-costate, costæ very slender and more or less setose above, margins obscurely bristly except at the tip where the bristles are long; petiole very short and rhachis and sheath armed with short hooked spines; rhachis fugaciously scurfy; sheaths green, glabrous. Spadix elongate, slender, drooping, flagelliferous. Spathes tubular, acuminate, sparingly spinous, fugaciously brown-scurfy, upper unarmed, spathels not imbricate, unarmed. Corolla thrice as long as the calyx. Fruiting calyx sessile, shortly cylindric, pedicelliform, lobes very short. Fruit oblong, ¾ inch long; scales straw-coloured, with or without a narrow brown border, channelled. Seed wrinkled.

HABITAT.—The Khasia Hills up to 4,000 feet; Upper Assam; Cachar; Chittagong.

FLOWERS.—In May.

40. *C. MELANACANTHUS*, Mart. Hist. Nat. Palm. III, 333, t. 116, f. 13; and t. Z. XXII, f. X; Kunth Enum. III, 211; Griff. in Calc. Journ. Nat. Hist. V, 49; Palms Brit. Ind. 59; Walp. Ann. III, 484, V, 830; Miq. Fl. Ind. Bat. III, 119; Palm. Archip. Ind. 27; Kurz in Journ. As. Soc. Beng. XLIII, II, 215, t. XX, B; Hook Fl. Brit. Ind. VI, 453; Brandis Ind. Trees 652; Becc. Rec. Bot. Surv. Ind. II, 208, Ann. Roy. Bot. Gard. Calc. XI, 96, 321; Wall. Cat. 8606 B.

DESCRIPTION.—Scandent. Leaflets many, 6-13 inches long, ½ inch broad, upper ones much shorter (2-3 inches), equidistant, membranous, linear with capillary tips, 3-costate, shortly setose or naked on the costæ beneath, tips sparsely bristly or naked, rhachis with a single row of short re-curved black spines; sheath with sub-whorled spines. Female spadix decompound, ending in a flagellum. Spathes shortly sparsely spinous, upper nearly unarmed. Fruiting calyx sessile, campanulate, pedicelliform. Fruit ellipsoid, ¾ inch long, shortly beaked, scales greyish yellow with very narrow brown margins, channelled; albumen deeply ruminate; embryo lateral.

HABITAT.—Tenasserim: Chappedong.

41. *CALAMUS ZEYLANICUS*, Becc. in Hook. f. Fl. Brit. Ind. VI, 455; Rec. Bot. Surv. Ind. II, 210; Ann. Roy. Bot. Gard. Calc. XI, 103, 379; Trim. Flor. Cey., IV, 335—*C. rudentum* (*non* Lour.) Moon, Cat. 26, Thw. Enum. 330 (*excl. omnibus smn. at C. P. exsicc.* No. 2874).

NAMES.—Mamewel, Wanderu-wel (Singh.)

DESCRIPTION.—Stem very stout, scandent; sheaths not flagelliferous. Leaves 4-5 feet long; petiole stout, armed with 3 fid recurved spines; rhachis very stout, its stout flagellum armed with large, broad, decurved, palmately 5-10-cleft, claw-like, woody spines, broader than the rhachis, young scurfy. Leaflets many, equidistant, ½-2 feet long and 1-1½ inch broad, ensiform, long, acuminate; veins 3-5, very sparingly setulose above, naked beneath. Lower spathe acute, armed with very short scattered spines, upper striate, unarmed or sparingly spinous, uppermost funnel-shaped, truncate. Male spadix decompound, the long spreading spikes with short spathels bearing short broad flat spikelets, ½-1 inch long, of most closely imbricate spathellules. Female spadix very stout, with much longer spikes. Flowers deeply sunk in the truncate spathellules, ovoid nearly ¼ inch long; calyx deeply 3-lobed; petals broad, connate at the base, both striate. Fruit seated on the enlarged perianth, globose, ¾ inch in diameter, yellow-brown; beak long, stout, conical, scales 8-10 in a vertical series, tumid, with narrow white furfuraceous margins and a deep central channel; seed globose, endosperm deeply ruminate, embryo lateral.

HABITAT.—Ceylon: Moist low country, rather common below 1,500 feet. Kalutara, Sabaragamuwa frequent.—(Endemic in Ceylon).

42. *CALAMUS OVOIDEUS*, Thw. ex Trim. in Journ. Bot. XXIII, 269 (1885); Hook. Fl. Brit. Ind. VI, 457; Trim. Fl. Ceyl. IV, 335; Becc. in Rec. Bot. Surv. Ind. II, 211, Ann. Roy. Bot. Gard. Calc. XI, 104, 382.

NAME. Ta-mbutu-wel (Singh.)

Stem stout, scandent. Leaves 14 feet long, including the flagellum, and more; leaflets 10-24 inches long and ¼-1 inch broad, equidistant, alternate, broadly linear, acuminate, tip bristly, 3-veined, setulose beneath, margins smooth; rhachis fugaceously scurfy, margins prickly, dorsally rounded, with solitary hooked spines; flagellum armed with short, broad, many-toothed spines; sheath densely armed with rings of flattened, deflexed, often lacerate, black spines. Lower spathes armed with short, black, reflexed spines. Flowers not seen. Fruit seated on the shortly pedicelled slightly enlarged perianth, ¾ inch long; obovoid, strongly beaked, scales 10-12 in a vertical series, tumid, deeply channelled in the centre, pale yellowish-grey, bordered with orange-brown.

HABITAT.—Ceylon: Moist low country, rare, Sabaragamuwa.—Endemic in Ceylon.

43. *CALAMUS ANDAMANICUS*, Kurz in Journ. Asiat. Soc. Beng.. XLIII, pt. 2 (1874), 211 pl. XXVII-A and XXVIII and Vol. XLV, pt. 2 (1876), 151; For. Fl. Brit. Burm. II, 519; Hook. F. Fl. Brit. Ind. VI, 457; Becc. in Rec. Bot. Surv. Ind. II, 211, Ann. Roy. Bot. Gard. Calc. XI, 104, 385.

VERNACULAR NAMES.—Chowdah, Charab (Andamans), Nat (Nicobars).

DESCRIPTION.—Stem lofty, scandent, as thick as an arm (with the sheaths on). Leaflets 2-2½ feet long, 1 inch broad, alternate, equidistant, linear, subulate-acuminate, 3-costate, margins thickened and costæ setose; petiole and rhachis armed with stout, recurved spines; petiole with blackish, tuberous-based spines mixed with long black ones, sheath red brown, covered with seriate whorls of capillary black and broad flat black spines. Spadix decompound, nodding; spathes subcompressed, armed with strong, reflexed, solitary and ternate spines, partial unarmed. Fruit distichous, elliptic-ovoid, about ½ inch long, uniformly brown; scales rhomboid, greenish, bordered with chesnut-brown, rather flat, not furrowed, tips prolonged into a lanceolate, pale brown, opaque acute, ciliolate, membranous appendage, longer than the scale itself. Seed semiconvex, grooved; albumen equable.

HABITAT.—Andaman and Nicobar Islands, Coco Isles.

USES.—The radical (not cirriferous) leaves are employed for thatching, and then the plant receives the name of Hok-Neak (*ex* Becc.).

44. *C. PALUSTRIS,* Griff. in Calc. Journ. Nat. Hist. V, 62, Palms Brit. Ind. 71, t. 199; Mart. Hist. Nat. Palm. III, 339; Miq. Fl. Ind. Bat. III, 131; Walp. Ann. III, 490, V, 831; Hook. Fl. Brit. Ind. VI, 458; Brandis Ind. Trees 654; Becc. in Rec. Bot. Surv. Ind. II, 211, Ann. Roy. Bot. Gard. Calc. XI, 106, 401.—*C. latifolius,* Kurz (*non* Roxb.) in Jour. As. Soc. Beng. XLIII, II, 210, t. 31 A; For. Fl. II, 518 (*partim*).

VERNACULAR NAMES.—Yamata (Burma), Wai (Andamans).

DESCRIPTION.—Stem scandent, glabrous throughout, with the sheaths about 2-3 inches in diameter. Leaves 8-12 feet long, short-petioled; leaflets 1-2 feet long, 3-5 inches broad, rather thin, uniformly green, alternate, the median approximate in pairs, broadly elongate-lanceolate, acuminate with bristly tips, 3-costate and many-nerved, margins not thickened and costæ smooth; petiole with 1-2 rows of short, very broad, fascicled or simple hooked spines with swollen bases; sheath green, sparingly armed with short black or broad hooked spines. Spadix bifariously decompound, elongate, drooping. Spathes tubular, obliquely truncate, armed with recurved spines; spathels glabrous. Fruiting perianth stellate. Fruit ellipsoid-oblong, about ½ inch long; scales obtuse, slightly biconvex, hardly channelled, pale brown with a blackish border. Seed almost semi-convex, grooved and irregularly wrinkled.

HABITAT.—Tenasserim, Perak, Andaman Islands, Nicobars.

FLOWERS.—In October.

USES.—This calamus is used by the natives of the Andamans to make knives known by the name of Wai-cho (Man, 'The Andaman Islanders,' *ex* Becc.).

45. *C. LATIFOLIUS,* Roxb. Fl. Ind. III, 775; Mart. Hist. Nat. Palm. III. 339, t.160, f. 5; Griff. in Calc. Journ. Nat. Hist. V, 60; Palms Brit. Ind. 68, t. 198 (*excl. cit.* Hort. Malab.); Kurz in Journ. As. Soc. Beng. XLIII, II, (*excl.* t. 31 A); For. Fl. II, 518 (*partim*); Hook. Fl. Brit. Ind. VI, 455, (*excl. C. inermis,* T. Anders.); Brandis Ind. Trees 653; Becc. in Rec. Bot. Surv. Ind. II, 211, Ann. Roy. Bot. Gard. Calc. XI, 107, 406.—*C. macracanthus,* T. Anders. in Jour. Linn. Soc. XI, 10.—*C. humilis,* Roxb. Fl. Ind. III, 773.

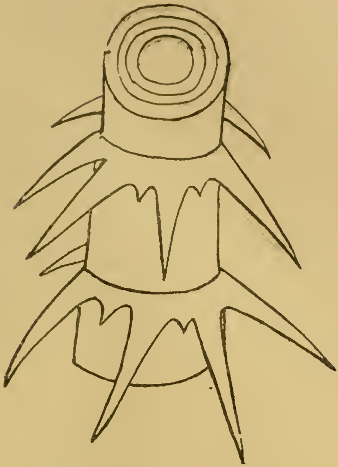


FIG. 4 Part of stem of *Calamus latifolius*.

NAMES.—Korak Bent (Beng.); Yamata (Burm.), Ruebee Greem and Phekori-Bhet (Lepchas).

DESCRIPTION.—Stem stout, as thick as the thumb. Leaves with the flagellum 10-15 feet; leaflets 1-2 feet long, 1-2½ inches broad, scattered or binate, upper sometimes flabellately clustered or connate at the base, elliptic or elliptic-lanceolate, 3-9-costate, tips setose, margins aculeolate, costæ naked on both surfaces, cross nervules very many and close; petiole short or long, sometimes bearing the leaflets far up the flagellum; rhachis flagelliferous very stout, variously armed with scattered spines; sheath densely covered with very short broad whorled spines and a few very large straight flat solitary or whorled ones. Spadix very large, decompound. Spathes short, subcompressed, sparsely spinous, mouth oblique; spathels short. Male spikes densely imbricate. Fruiting calyx sessile, pedicelliform, broadly campanulate, lobes short. Fruit subglobose, pale dull yellow; scales convex, deeply channelled, shining, margin very narrowly scarious.

HABITAT.—From the Sikkim, Himalaya and Assam (2,000 feet) to Tenasserim.

FLOWERS.—In November and December.

CALAMUS LATIFOLIUS, Roxb., var. *marmoratus*, Becc. in Ann. Roy. Bot. Gard. Calc. XII, 107, 409.

VERNACULAR NAME.—Ruebee (Lepchas).

DESCRIPTION.—More slender than the type. Leaf sheaths about 2 cm. in diameter, marbled with mealy and dark green spots and armed with verticillate broad-based and smaller interposed spines. Leaves smaller, with fewer pairs of leaflets; leaflets 25-28 cm. long and 6 cm. broad at most.

HABITAT.—Sikkim, Himalayas.

46. *CALAMUS DORIÆI*, Becc. in Hook. f. Fl. Brit. Ind. VI, 456; Rec. Bot. Surv. Ind. II, 211, Ann. Roy. Bot. Gard. Calc. XI, 111, 430.

DESCRIPTION.—Apparently rather large and scandent. Female spadix with rigid, arched, partial inflorescences, which terminate in a slender barely spinulous, tail-like appendix. Spikelets spreading, callous at their axils, arched, zigzag, sinuous, up to 6 cm. long, with 7-9 horizontal flowers on each side. Fruiting perianth depressedly ventricose. Fruit elongate-ellipsoid, stoutly beaked, 22-25 mm. long, 11-12 mm. broad. Scales in 21 series, narrowly and deeply channelled. Seed oblong sub-cylindric, pitted; albumen superficially ruminate; embryo sub-basilar.

HABITAT.—Burma, Karin Gheccu mountains.

47. *CALAMUS POLIDESMUS*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 111, 430.

DESCRIPTION.—Scandent, apparently rather robust. Leaflets distinctly grouped in fascicles of 2-3 on each side of the rhachis, linear lanceolate, accuminate, 20-22·cm. long, 18-25 mm. broad, sub-5- costulate, the costæ quite smooth on both sufaces; margins spinulous-serrulate. Female spikelets spreading, callous at their axils, about 10 cm. long with 9 distichous flowers on each side. Fruiting perianth cylindric.

HABITAT.—Central Burma.

FRUIT.—In March.

48. *CALAMUS KHASIANUS*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 111, 431.

DESCRIPTION.—High scandent and very robust. Sheathed stem 5 cm. in diameter, naked canes 2½-3 cm., the internodes about 25 cm. long. Leaf-sheaths armed with very large laminar spines. Leaves very large; petiole very short. Leaflets numerous, 2-4 approximate on each side of the rhachis, with long vacant spaces interposed, lanceolate ensiform, 40-50 cm. long, 2½-3½ cm. broad, 3-5-costulate, the costæ almost smooth on both surfaces or sparingly spinulous above; margins spinulous. Female spadix diffuse, 1·2-1·5 m. long, with many partial inflorescences, which are arched and spreading with distinct callus at their axils. Spikelets zigzag sinuous, up to 20 cm. long, with 15-16 flowers on each side; spathels asymmetrically infundibuliform. Fruicing perianth cylindric. Fruit almost sphæric, 26-27 mm. long. Scales in 18 series, deeply channelled. Seed globular, coarsely pitted; albumen superficially ruminate; embryo basal.

Habitat.—Khasia Hills.

Uses.—Fruit edible.

49. *CALAMUS NAMBARIENSIS*, Becc. in Ann. Roy. Bot. Gard. Calc. XI, 111, 433.

Vernacular Name.—Hoka Bhet (Assam).

Description.—Scandent, rather robust. Leaf-sheaths 3-4 cm. in diameter, armed with large, broad, sub-seriate, horizontal or deflexed spines intermingled with smaller ascendent ones. Leaves 3 m. long in the pinniferous part; petiole very short. Leaflets spreading, remotely sub-equidistant, lanceolate-ensiform, about 50 cm. long, 4 cm. broad with 3 or sometimes 5 smooth costæ; margins obsoletely spinulous. Male spadix simply decompound or partially supra-decompound; spikelets callous at their axils, spreading or deflexed, 3-4 cm. long, flowers on each side. Spathels closely packed, concave, ovate, bracteiform. Fruit apparently similar to that of *C. Khasianus*, but more ovoid and with scales in 21 series.

Habitat.—Assam.

50. *CALAMUS INERMIS*, T. Anders Jour. Linn. Soc. XI, (1869) 11; Gamble Man. Ind. Timb. 424.—*C. latifolius* (*non* Roxb.) Becc. in Hook. f. Fl. Brit. Ind. VI, 455 (*partim*).

Description.—High scandent and robust. Leaf-sheaths 5-6 cm. in diameter smooth. Leaves about 3 m. long in the pinniferous part; the cirrus 2 m. long, powerfully clawed; petiole short, smooth. Leaflets numerous, inequidistant, in pairs on each side of the rhachis, 3-9-costulate, the lower ones ensiform, 40-50 cm. long, 3-4 cm. broad, the others shorter and broader, lanceolate; the costæ smooth on both surfaces; margins spinulous. Female spadix strict; partial inflorescences and spikelets not callous in their axils; spikelets inserted inside the mouth of their spathe, 8-10 cm. long, with 8-10 flowers on each side, zigzag sinuous between the flowers. Fruiting perianth ventricose. Fruit ellipsoid, 27-29 mm. long, 13-14 mm. broad. Scales in 18 series, deeply channelled. Seed ovoid, sinuously grooved.

Habitat.—Hot and damp valleys of the Sikkim Himalaya.

51. *CALAMUS UNIFARIUS*, H. Wendl. in Bot. Zeitg. XVII (1859), 158; Miq. Fl. Ind. Bat. III, 749 et De Palmis 28; Becc. in Rec. Bot. Surv. Ind. II, 212, Ann. Roy. Bot. Gard. Calc. XI, 114, 456.—*Calamus spp.* Nos. 9 et 14, Zoll. Syst. Verzeichn. 79.

VAR. *PENTONG*, Becc. in Hook. f. Fl. Brit. Ind. VI, 458, Rec. Bot. Surv. Ind. II, 212, Ann. 114, 458.

Vernacular Name.—Pentong (Nicobars).

Description.—Scandent, robust. Leaf-sheaths 3-3½ cm. in diameter, armed with long acicular bulbous spines. Leaves large, 1·7 m. long in the pinniferous part. Leaflets not very numerous, subequidistant, 6-10 cm. apart, lanceolate, or lanceolate-ensiform, with 5-7 slender costæ which are smooth on both surfaces. Male spadix ultra-decompound with several panicled-pyramidate partial inflorescences. Spikelets (fig. 5) distinctly callous in

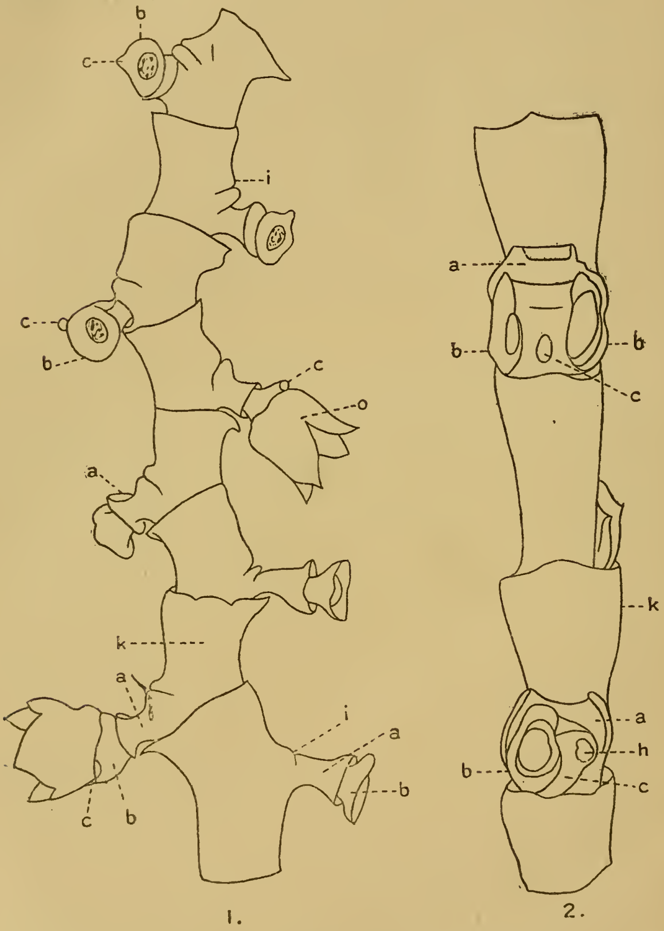
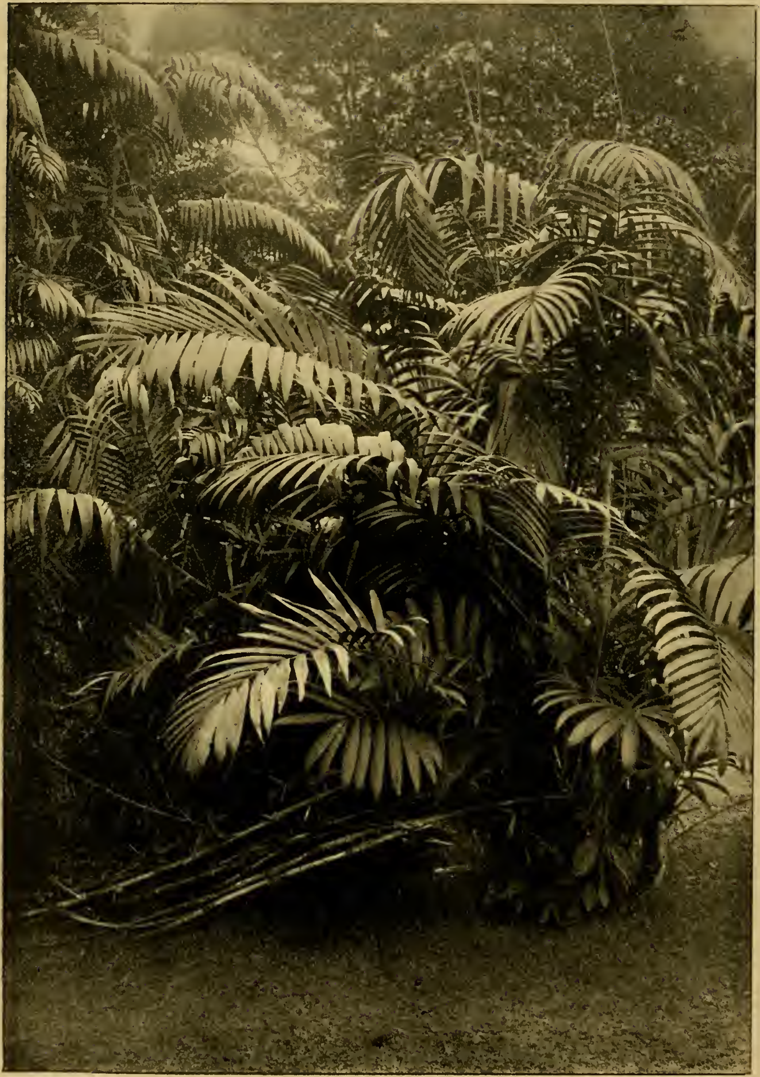


Fig. 5—

1. Portion of flowering spikelet of *C. unifarius* var. *pentong*.
2. Portion of a fruiting spikelet of *C. didymocarpus* for comparison *a*=involucrophorum. *b*=involucre. *c*=areola. *h*=scar of areola. *i*=axillary callus. *k*=spathel. (After Beccari).



Calamus Scipionum, Lour.

the axils, very slender, arched, their axes filiform, 1-3 cm. long, with 5-15 distichous flowers on each side; involucre calyculiform, subtending and not enveloping the flower. Female spadix simply decompound, similar to the male one, terminating in a rather elongate flagelliform appendix; spikelets slender, 5-8 cm. long with 15-20 bifarious flowers on each side; involucrophorium more or less distinctly pedicellate. Fruiting perianth pedicelliform. Fruit globose, 1 cm. in diameter. Scales subsquarrose in 15 series, not distinctly channelled. Seed irregularly globular, coarsely pitted, albumen sub-ruminate; embryo basal.

HABITAT.—Nicobar Islands.

52. *CALAMUS SCIPIONUM*, Lour. Fl. Cochinch. 3,210; Lam. Encycl. VI, 304, *non* Illustr. and *excl. syn.*); Mart. Hist. Nat. Palm. III, 342; Kunth Enum. III, 206; Griff. in Calc. Journ. Nat. Hist. V, 35; Palms Brit. Ind. 43; Miq. Fl. Ind. Bat. III, 138; Hook. f. Fl. Brit. Ind. VI, 461.—*C. micranthus* Bl. Rumph. III, 53 (*fol. tantum*), t. 157 (*excl. spad.* and *anal. fl.*).—Ching, Griff. ll. cc. 37, 46.

DESCRIPTION.—Stem 40-60 feet high, sheath 2-3 inches in diameter. Leaves 4-5 feet long; flagellum 10-12 feet long; leaflets numerous, firm, equidistant, upper gradually smaller, elongate-lanceolate or subensiform, aculeolate, tips bristly; rhachis as thick as the little finger, smooth except from the scattered spines, obtusely trigonous ⊓; costæ 5-7, naked on both surfaces or sparsely aculeolate beneath; margins of leaflets nearly smooth, uppermost pair connate at the base; petiole armed with very stout conico-subulate scattered recurved spines.

Spadices very long flagelliferous; lower spathes very long, tubular, unarmed, or their keels armed. Male spadix about 20 feet long, female about 10 feet; spathels 1 inch long, tubular, truncate, smooth, unarmed, or with a few conical tubercles; branches of female spadix long; spikes 2-4 inches, rather distant, spreading and recurved, stout; spathellules and bracts very short imbricate; female flowers sessile.

Fruiting calyx very small, pedicelliform, broadly urceolate, base truncate intruded, mouth much contracted, lobes very short. Fruit small, ovoid or globose, abruptly mammillate, brown, scales shining, tumid, with broad pale scarious margins. Seed when young subovoid, alveolate, embryo basilar.

DISTRIBUTION.—Malaka, Perak, Borneo. Sometimes found in Indian gardens.

ILLUSTRATION.—Plate CVI.

UNRECOGNIZED SPECIES.

C. QUINQUENERVIUS, Roxb. Fl. Ind. III, 777; Kunth Enum. III. 209; Mart. Hist. Nat. Palm. III. 339; Griff. in Calc. Journ. Nat. Hist. V, 61; Palms Brit. Ind. 72; Hook. Fl. Brit. Ind. VI, 460; Brandis Ind. Trees 654; Becc. in Rec. Bot. Surv. Ind. II, 215; Ann. Roy. Bot. Gard. Calc. XI, 503.

NAMES.—Hurnur-gullar (in Silhet).

DESCRIPTION.—Scandent, stem when cleaned about as thick as a man's finger throughout, the joints from 6-8 inches long. Leaves flagelliferous; leaflets few, remote, alternate, equidistant, narrowly lanceolate, 5-nerved. Spines in belts, distinct, few, short and strong. Spadix decompound. Fruit spherical.

Hooker and Beccari have not been able to recognize this species.

HABITAT.—Silhet.

PLECTOCOMIOPSIS, Becc.

(From Plectocomia (cf. foregoing genus) and "opsis" appearance).

"Characters of Plectocomia, but upper leaves reduced to sheaths with long flagella and no leaflets, spathels small, infundibular, and fruit clothed with very minute, almost microscopic scales, arranged in vertical series. Seed globose, smooth; albumen equable; embryo basilar. Species 3, Malayan." (Hooker.)

Plectocomiopsis paradoxus, Becc. in Hook. Fl. Brit. Ind. VI, 480; Brandis Ind. Trees 650.—*Calamus paradoxus*, Kurz in Journ. As. Soc. XLIII, II, 213, t. 29, 30; Forest Fl. II, 521.

An evergreen, extensive climber, all parts glabrous; stem with the sheaths 1-2 inches in diameter; leaves pinnate, 5-7 feet long terminating in a whip-like hooked-thorny tendril; petiole short, along with the lower part of the rhachis indistinctly puberulous and armed underneath and near both margins with more or less straight, sharp thorns; sheaths armed with yellowish, sharp, flat spines arranged into combs; leaflets 1-1½ feet long, up to 1 inch broad, of a thin texture, alternating by pairs and remote marginate, shortly acuminate, inconspicuously and remotely appressed-ciliolate. Male spadix bifariously decompound ample, drooping; spathes all smooth, tubular, with a truncate, shortly acuminate limb; spathules similarly shaped, but much smaller, embracing the base of the very short (1-3 lin. long), distichously imbricate bracted male spikelets; bracts spreading, ovate, acute about 1 lin. long, brown, glabrous. Male flowers: calyx about 1 lin. long, deeply 3-cleft, striate; petals rigid, connate at the base, nearly 2½ lin. long, oblong, acute; stamens 6; filaments rigid, the lower part linear-oblong, longer and broader than the anthers, terminating in an infracted thread, from which the anther is versatilely suspended; pistillode hardly any.

HABITAT.—Martaban; in the evergreen tropical forests of Palawa Zeik, east of Tounghoo.

Flowers in April.

DÆMONOROPS, Blume Rumph. II., t. 131 ; III., 2, t. 138-145. (From the Greek "daimon," an evil spirit, and "rhops," a low shrub).

Mart. Hist. Nat. Palm. III, 203, 326, t. 117, 125, 175-177 ; Kunth Enum. Pl. III, 204 ; Miq. Fl. Ind. Bat. III 81, suppl. 90, 255, 592. Luers. Botan. II, 329 ; Hook. Fl. Brit. Ind. VI, 452.

The general characters are the same as those of *Calamus*, but the outer sheaths or spathes are cymbiform, deciduous, at first enclosing the inner ; the flowers are often more pedicellate (fig. 6.).

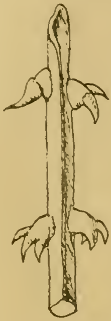


Fig. 6.—Cirrhus of a *Dæmonorops*.

Species about 80. Distribution :—That of Calamus.

DÆMONOROPS Jenkinsianus, Mart. Hist. Nat. Palm. III., 327 ; Walp. Ann. III. 475, V, 827 ; Hooker Fl. Brit. Ind. VI. 462 ; Brandis Ind. Trees 650.—*D. nutantiflorus*, Mart. l. c. 326 ; Walp. ll. cc. 474 and 827. —*Calamus jenkinsianus*, Griff. in Cal. Journ. Nat. Hist V, 81 ; Palms Brit. Ind. 89 (*excel.* fruit *et* t. 186 A. f. 3) ; T. Anders. in Journ. Linn. Soc. XI, 11.—*Calamus nutantiflorus*, Griff. in Cal. Journ. Nat. Hist. Vc. 79 ; Palms Brit. Ind. 88, t. 208.

Name.—Gola Bent (Ass.).

Description.—Stem scandent, very stout, with the sheaths $1\frac{3}{4}$ inch in diameter ; young parts grey-pubescent. Leaves large ; leaflets 2 feet by $\frac{2}{3}$-$\frac{3}{4}$ inch, equidistant, linear, finely acuminate ; costæ 3, all sparsely setose above with very long bristles, the central only beneath, margins setulose. Petiole, rhachis and flagellum with many marginal and dorsal hooked spines or 3-5-fid claws ; sheath armed with very long flat, deflexed and shorter more slender spines.

Spadix elongate, decompound ; outer spathe 1-2 feet long, flattish, 2 keeled, armed with flat spines, narrowed into a long spinescent beak, spines $\frac{1}{2}$-$\frac{3}{4}$ inch, inner spathe 12-18 inches long, lanceolate, long-acuminate, quite smooth. Male spadix thyrsiform, dense-flowered ; calyx oblong, 3-dentate, petals and bracts deeply grooved. Female spadix with spreading branches, fruiting erect; calyx cupular, not pedicelliform; petals twice as long.

Fruit globose, apiculate, $\frac{2}{3}$ inch in diameter, pale yellow brown; fruiting calyx nearly flat; scales deeply channelled, margins narrowly scarious. Seeds subglobose, smooth; albumen punctate, or the surface ruminate by very slender channels, (fig. 7.).

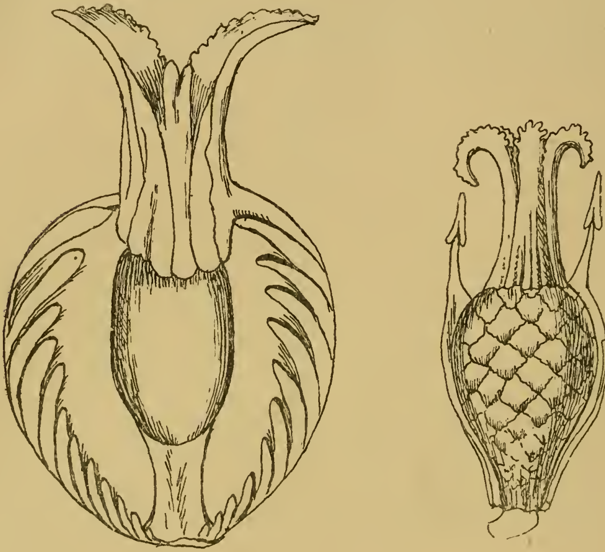


FIG. 7.—Left: Vertical section of fruit of *Dæmonorops jenkinsianus*. magnified. Right: Young fruit of *Calamus Griffithianus*. magnified (after Martius.)

DISTRIBUTION.—Sikkim, Himalaya, Assam, Khasia Hills, Bengal, Chittagong.

DÆMONOROPS MANII, Becc. in Hook. Fl. Brit. Ind. VI, 463, Brandis Ind. Trees 650.

"Leaflets very many and narrow, naked beneath, setulose on the 3 costæ above; spadix very long, slender; peduncle compressed, hardly armed; outer spathe very long, gradually narrowed into a long, pale, dorsally keeled beak, spines few, large, flat; inner lanceolate, acuminate. Fruiting spadix erect, glabrous; fruit globose, shortly mammillate; scales pale, slightly channelled, margins pale, tip not discoloured." Hooker.

HABITAT.—Andaman Islands.

DÆMONOROPS KURZIANUS, Hook. f. Fl. Brit. Ind.; Brandis Ind. Trees 650.—*D. grandis*, Kurz in Journ. As. Soc. Beng. XLIII, II, 208 (not Mart).—*Calamus grandis*, Kurz For. Fl. II, 523 (not of Griffith).

A lofty climber, the sheathed stems as thick as the arm, the canes up to 1 inch in diameter. Leaves 4-6 feet long, shortly petioled; leaflets 1-2 feet long, 1-1¼ inch broad, very many, equidistant, elongate, ensiform, acuminate, margins minutely aculeolate, tips ciliate, costæ 3-5, naked or with a few long bristles above; rhachis enormously stout, 1½ inch in diameter, semi-terete, flat above with short scattered spines on the margins, dorsally convex and unarmed, ending in a clawed flagellum; petiole very stout, armed below with long, flat and short recurved spines; sheath with whorled spines. Outer spathe cymbiform, scurfy, with seriate spines; inner linear, unarmed. Fruiting spadix erect, branches very stout. Fruit globose, ⅔ inch in diameter, very shortly beaked, pale brownish yellow; scales deeply channelled, margins brownish with a very narrow scarious edge; fruiting calyx with a very short base and broad, striate lobes; petals twice as long, striate; seed subcompressed; albumen punctate, or the surface ruminate by very slender channels.

HABITAT.—South Andaman Islands.

USES.—*D. kurzianus* is the only species hitherto reported as affording the so-called "East Indian Dragon's blood." This is for the most part prepared from the fruits of several species of Calamus, growing in Eastern Sumatra, South Borneo, and Penang. The gum exudes naturally from between the scales of the fruit, but inferior qualities are obtained by boiling the fruits or by tapping the stems. The false Dragon's blood of the Indian market is imported into Bombay from Sumatra, Penang, etc., in large cakes or compressed in Bamboo tubes. The true Dragon's blood is procured from Sokotra, and is obtained by tapping the stems of several species of Dracæna.

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NEW INDIAN SCROPHULARIACEÆ AND SOME NOTES ON THE SAME ORDER.

BY

E. Blatter, S.J., and Prof. F. Hallberg.

BONNAYA, Link. & Otto.

Bonnaya bracteoides, sp. nov. (near *B. brachiata*, Link. & Otto).

Stem erect, up to 8 cm. high, subsimple or diffusely branched. Branches stout, rigid, quadrangular, grooved, glabrate or with a few minute hairs. Leaves opposite, sessile, ovate-elliptic, up to 22mm. long and 11mm. broad, in some specimens only $\frac{1}{2}$-$\frac{1}{4}$ as large, very sharply spinous-serrate; teeth about a dozen pairs, up to 1·5mm. apart. Flowers in terminal or axillary racemes. Pedicels terete, stout, 1-bracteate, in fruit reaching 5mm., opposite, but with a tendency to collect into whorls or clusters, especially at the top of the raceme. Bracts: the lowest pair leaf-like, the next smaller, narrower, elliptic or linear, toothed, then linear-spathulate with about one pair of teeth near the apex, at last very small, entire, subulate, generally of the length of the pedicel. Calyx in flower 4, in fruit 5mm. long, subequally 5-lobed nearly to the base, lobes linear-lanceolate, acute, margins with minute stiff hairs directed upwards. Corolla 7mm. long, white, spotted with pink, tube 4mm. long, narrow, cylindrical, outside with minute capitate hairs, lower lip 3mm. deeply 3-lobed, midlobe larger; upper lip a little over 2mm. long, rectangular, half as broad as long, emarginate. Stamens 2 perfect, inserted near junction of lips; filaments very short, rather stout, glabrous: pollen globose. Staminodes 2, inserted on the throat of the lower lip, reaching higher than the stamens (up to the sinus of lower lip), their lower half broad, connate with the corolla, the upper narrow, bent outwards. (They are very similar to those of *B. brachiata*, L. & O., but only obscurely glandular, not pubescent). Style 4mm. long, glabrous, stigma bilamellate, bent over to one side, lobes about equal. Capsule 10mm. long, terete, glabrous. Seeds subglobose or pear-shaped, with a minute tail, obscurely rugose.

This species is distinguished from *B. brachiata* chiefly by its bracts, the different arrangement of its flowers and the glabrous staminodes.

Locality: Found in October 1916 in various places of Mt. Abu, 4,000 ft. (Herb. St. Xavier's College, Nos. 1514, 1515, 1516.). Common among grass on wet ground.

Bonnaya estaminodiosa, sp. nov. (near *B. oppositifolia*, Spreng.).

Stem erect, 6cm. high, stout, quadrangular, nearly glabrous, sparingly branched. Leaves opposite, except the uppermost which are opposite to a pedicel, sessile, erect, linear, 30×5mm., distantly, shallowly serrate (teeth about 3mm. apart), penninerved, midrib very prominent, the others obscure, margin with tubercles and some minute stiff hairs.—Flowers in lax terminal and lateral racemes, consisting of about 5 distant pairs of pedicels and, in addition, some solitary leaf-opposed ones below. Bracts of about the same length as the pedicels, rather broad at the base, keeled acuminate, (hairiness like that of the sepals). Pedicels up to 7mm. in fruit spreading, stout, flat above, convex below. Calyx in flower 4, in fruit 6mm. long, divided nearly to the base; lobes 5, subequal, subulate; margins and midrib scabrous with minute distant stiff bristles. Corolla 5·5mm. long, white, lower lip spotted with pink; tube straight, 3mm. long, narrow, not widening, with a few minute capitate hairs. Lips about equal in length. Upper lip erect, entire, slightly more than 1mm. broad, tip rounded, with a few short bristles; lower lip spreading, 3-lobed, lobes about equal, tips like that of the upper lip. Stamens 2, subincluded; filaments very short, a little compressed, glabrous; anther reaching about half-way up the lower lip; pollen globose. Staminodes absent. Style 3mm., rather stout, glabrous; stigma bilamellate, bent over to one side; lobes broad, one slightly larger. Ovary ovoid, glabrous.—Capsule 10 mm. terete. Seeds ovoid-globose, rugose with numerous circular depressions in rows.

The distinguishing character of this species is the absence of staminodes and the colour of the flowers. Found in November 1916 at Mahim, Bombay Island, among grass (Herb. St. Xavier's College, No. 1517).

Bonnaya quinqueloba, sp. nov. (near *B. oppositifolia*, Spreng).

Stem erect, 6·5cm. high, sparingly branched. Leaves, bracts, and pedicels like those of *B. estaminodiosa*, except for the lowest leaves which are subentire —Flowers in terminal or lateral racemes, the lowest flowers axillary. Calyx like that of *B. bracteoides*. Corolla 6mm. long, tube 3mm., cylindrical, rather wide, outside with a few minute capitate hairs. Upper lip 2mm., entire, erect, tip rounded. Lower lip shallowly 5-lobed. Midlobe the largest, the two adjacent ones not much smaller, the last two very small, but distinct, one larger than the other; all lobes rounded. Corolla white, lower lip with pink-purple spots. Stamens like those of *B. estaminodiosa*. Staminodes 2, not reaching as high as the stamens, very small, narrow, linear, acute, inserted on the throat of the lower lip, straight, glabrous. Style 3·5mm. long, glabrous.—Capsule 9mm. long, 1¼mm. broad, tapering, acute, minutely striate. Seeds irregularly ellipsoidal, rugose, with numerous minute circular depressions.

The main distinguishing characters of this species are the shape and colour of the corolla, the absence of leaf opposed flowers below the raceme. Leaf-opposed flowers are present in *B. estaminodiosa*, and, according to Roxb. Corom. Plants II. 157, also in *B. oppositifolia*, Spreng.

Found in November 1916 at Bhandup in Salsette, in rice-fields (Herb. St. Xavier's College, No. 1518).

Bonnaya micrantha, sp. nov.—A small herbaceous plant. Stem up to 10cm. high, with a few pairs of decussate branches, which may again branch in a similar manner. Stem and branches rather stout, quadrangular; angles hairy with short stiff tapering hairs. Leaves opposite, subsessile, up to 25 × 19mm., broadly ovate or suborbicular, regularly strongly serrate-dentate; nerves 3-7, from the base or nearly so, sometimes the midrib which is strongest, with 1-3 secondary nerves, all prominent beneath; both surfaces of the leaves nearly glabrous, margin hispid with minute stiff hairs (or teeth minutely serrulate).—Profusely flowering from all the axils, even the lowest; the flowers are either sessile, crowded in the axils, or with slender subquadrangular pedicels, reaching 2cm. in length, which are either glabrous or nearly so; the sessile flowers are apparently always present, while the pedicelled ones are absent in some specimens. There seems to be no law as to the distribution of the latter. In one specimen (Igatpuri) the main stem is terminated by an umbel with a peduncle 3cm. long, which is slender, 4-grooved, slightly hispid, bearing 4-pedicelled flowers Bracteoles minute, triangular, acuminate, spinous-serrulate, one at the base of each pedicel or subtending a sessile flower. Flowers very minute, but the calix is much enlarged in fruit, when it attains 3mm. in length, teeth ½ the length of the tube, ovate-acute, minutely sparsely hispid, 1-nerved, nerves running down the tube as ribs; fruiting calyx almost always split down to the base on one side. The corolla is white, 2-lipped, divided half way down, cylindrical, rounded at the tip (the lobes remaining as in bud, upper lip external), 1-1½mm. long, lips equal in breadth, upper lip suborbicular, hooded, tip emarginate or with a few irregular teeth, lower lip equally 3-lobed, as long as the upper and with suborbicular lobes or shorter than the upper and with oblong lobes. The corolla is persistent as a small cap on the beak of the growing capsule. Perfect stamens 2; filaments very short, stout, as long as or shorter than the anthers, anthers 2-celled, cells equal, situated at about the same height, slightly diverging below, anticous stamens reduced to minute staminodes, cylindrical, eglandular or with a lower, swollen glannular and upper subclavate eglandular part. Style very short, stout, conical; stigmatic branches conspicuous, longer than the style, reflexed, unequal in length.—Capsule elongate ovoid, 7mm. long, broadest below the middle (2·5 mm.), acutely beaked by the enlarged style, bivalved, the valves separating from the septum, but remaining united with each other at the apex. Seeds brown, ovoid, with a minute tail at one end, faintly longitudinally ribbed, obscurely rugose, sometimes slightly echinulate.

Locality: Mt. Abu, on walls, Oct. 1916 (No. 1734), Igatpuri, Sept. 1917 (Nos. 1735, 1736), Lonavla (No. 1765).

This is a very distinct species and of interest from several points of view. It differs from the other species of *Bonnaya* with regard to the capsule and the nervation of the leaves.—The corolla is easily overlooked, the most conspicuous feature of the plant being the profusion of fruits. The corolla never opens and, thus, self-pollination is the only possibility. It is perhaps worth mentioning that so far no corolla has been observed in the pedicelled flowers. The pedicel may have developed after flowering.

Bonnaya brachiata, Link & Otto.—This plant is very common near Bombay during the rains. In addition to the localities given by Cooke we have obtained the plant from Bombay Island (No. 1526), Salsette (Nos. 1501, 1502, 1503, 1504, 1505, 1506), Khandala (No. 1507), Igatpuri (Nos. 1509, 1510, 1511, 1512, 1513).

It varies considerably with regard to the size of all its parts, branching, form and colour of the corolla, etc. The bracts are always uniform, subulate. The staminodes are shaped like those of *B. bracteoides*, but the broad lower part is pubescent, the hairs being either white or assuming the colour of the corolla. In this species as well as in the three species described above, we have always found a few minute capitate hairs on the outer side of the corolla. Extreme measurements of the corolla: 11mm., white with purplish blue spots (No. 1512), 5·5mm., pink (No. 1505).

Bonnaya veronicæfolia, Spreng.—This plant seems to be rare about Bombay. We have seen specimens only from Kakeri (No. 1519) and Kodaikanal Road (No. 1520).

Bonnaya grandiflora, Spreng.—This, on the other hand, is rather common. It was obtained from Campooli (No. 1521), Salsette (No. 1522), Penn (No. 1523), Begur in Mysore (No. 1524).

Bonnaya verbenæfolia, Spreng.—It is not common. We have got it from Castle Rock (No. 1525) and from damp spots on the slope of the High Wavy Mountain in Madura, alt. 3,000 ft. (Nos. 505, 506).

As regards *B. veronicæfolia*, *B. grandiflora*, and *B. verbenæfolia*, there is apparently no reason why they should not be regarded as distinct species. J. D. Hooker has brought the last two under the first as varieties. The habits of the plants, however, are entirely different, and agree well with the figures in Roxb. Cor. Pl. II. 154, 179, and Wight Ic. t. 1412, taken in order. Only the staminodes are not drawn accurately. They are yellow in all our specimens, united with the corolla for about $\frac{2}{3}$ of their length, parallel; the lower portion is broad, yellow-pubescent; the free upper part narrow, glabrous, much bent outwards and on itself, tip glandular, obtuse. When straightened out the tip reaches beyond the sinus in the lower lip.

The measurements given in Hooker's Fl. Brit. Ind. and Cooke's Fl. B. Pr. for the corollas of the three plants in question are contradictory. As a matter of fact, all have rather large flowers, up to 12mm. long, *B. grandiflora* perhaps the largest.

The seeds are always rugose with small circular pits arranged in rows.

The citation of Wight Ic. t. 144 for *B. veronicæfolia* is somwhat doubtful, because of the close serrature of the leaves in the plant figured. It may be *B. reptans*, Spreng., a plant which has not been observed by us in the field.

In our opinion the character of the genus should be widened in order to include *B. estaminodiosa*. The genus *Bonnaya* should, therefore, be distinguished from *Ilysanthes* by having no staminodes at all or entire ones, whilest *Ilysanthes* would be characterized by bilobed staminodes. Further, researches into the relationships between *Vandellia*, *Ilysanthes* and *Bonnaya* will probably show that it is impossible to separate the three genera by good characters and that they should be united into one.

ILYSANTHES, Raf.

It appears that considerable confusion prevails in the nomenclature of this genus as regards the two Bombay species: *Ilysanthes hyssopioides*, Benth. and *I. parviflora*, Benth. This seems to be due to some erroneous citations of Bentham's in DC. Prodr. X, 419-20.

Under *I. hyssopioides* he gives as synonyms: *Gratiola hyssopioides*, L. (correctly); Roxb. Cor. Pl. III, t. 203 (wrongly, as this plate gives Roxburgh's original *Gratiola parviflora*); *Bonnaya hyssopioides,* Wight Ic. III, t. 857 (wrongly).

Similarly under *I. parviflora*, Benth., *Gratiola parviflora,* Roxb. Cor. Pl. III., t. 204 (wrongly, it ought to be t. 203).

These mistakes are retained by J. D. Hooker, who adds to the confusion by expressly saying that *Gratiola hyssopioides*, Roxb. Cor. Pl. II, t. 128, as well as the corresponding description in the Fl. Indica do not refer to *I. hyssopioides*, Benth. Hooker refers the plate in question to *Dopatrium lobelioides*, Benth. (Fl. Brit. Ind. IV, 274), an entirely different plant, correctly figured by Wight (Ic. t. 859, also cited by Hooker).

Cooke in his Fl. B. Pr. is evidently at a loss, and excludes all references except Wight, Ic. t. 857, which he, too, wrongly refers to *I. hyssopioides*, Benth.

These mistakes should be corrected as follows:—

Ilysanthes hyssopioides, Benth. in DC. Prodr. X, 419.

Syn.—*Gratiola hyssopioides,* L. Mant. 174; Roxb. Cor. Pl. II, t. 128, Fl. Ind. 1, 141. *Bonnaya hyssopioides*, Benth. Scroph. Ind. 34.

The plant is apparently rare, at least in the Bombay Presidency. The localities given by Cooke must be regarded as very doubtful. They refer in all probability to *I. parviflora,* Benth. We found the plant at Khandala in August 1917, growing in a damp place near St. Peter's School (Herb. St. Xavier's College, Nos. 1527, 1528). It agrees in every respect with Roxburgh's figure.

In order to clear up doubtful points we give a description of the plant.

Stems several from the base, very weak, but rather stout, succulent simple or branched just above the ground. Leaves ovate or lanceolate, quite entire, subacute, up to 10 × 3mm. Pedicels attaining 3cm. in fruit, when they become reflexed. Corolla bluish-lilac, upper lip bilobed, with rounded lobes. Staminodes large, stout, clavate, glandular, yellow; near the tip and overtopping it a long narrowly linear or filiform apendage, hardly glandular; at the base of each staminode a tuft of clavate yellow hairs which continues along a line down the tube almost to its base. Seeds ellipsoid, subacute at one end, and with a minute tail at the other, somewhat compressed, the faces with a few strong longitudinal ribs, minutely transversely rugose.

In Roxburgh's figure the appendage of the staminodes cannot be distinguished.

The plant was also found on the slope of the High Wavy Mountain (Madura District), altitude 3,000 feet (Herb. St. Xavier's College, No. 1529). In this instance the plant has a more slender stem and smaller leaves than in the Khandala specimens. The leaves are up to 8mm. long, linear or linear-lanceolate. acute corolla lilac with purple veins on upper lip; tube wider; upper lip bifid; lobes subacute. The lateral appendage of the staminodes much shorter, not reaching beyond the tip, somewhat thicker, cylindrical.

Ilysanthes parviflora, Benth. in DC. Prodr. X, 419.

Syn.—*Gratiola parviflora*, Roxb. Cor. Pl. III, 3, t. 203; Fl. Ind. 1, 140. *Bonnaya hyssopioides.* Wight Ic. t. 857.—*Bonnaya parviflora*, Benth. Scroph. Ind. 34.

A very common plant at all times of the year, often frequenting rice-fields during the dry season. The leaves are generally subserrate, and the flowers white or nearly so. The length of the corolla cannot be a distinguishing character in the identification of these two species. *I. parviflora* may have the corolla 2-4 times as long as the calyx in the same specimen.

Also with regard to this species the staminodes have not been figured correctly by Roxburgh and Wight. Both represent them as subequally bilobed, whilst in reality they resemble those of *I. hyssopioides*, although they are smaller.

The usual height of the plant is about 10cm. We have, however, found specimens at Mt. Abu (No. 1546), measuring 33 cm.

We have specimens from the following localities:—Bombay Island (No. 1530), Uran Island (No. 1531), Penn, Colaba District (Nos 1532, 1533, 1534, 1535, 1536), Khandala (Nos. 1537, 1538, 1539), Igatpuri (Nos. 1540, 1541), Khandesh (Nos. 1542, 1543, 1544), Mt. Abu (Nos. 1545, 1546, 1547, 1548) Kambam, Madura District (No. 499), in which case the corolla is lilac.

KEY TO THE TWO SPECIES.

(1) Stems several from the root, simple. Leaves entire.
Pedicels attaining 3cm. Corolla bluish or purplish *I. hyssopioides.*
(2) Stem diffusely branched. Leaves often subserrate.
Pedicels rarely exceeding 1cm. Corolla usually whitish *I. parviflora.*

The seeds in the former are twice as large as those of the latter and the lower lip of the corolla at least twice as broad.

VANDELLIA, L.

Vandellia crustacea, Benth.—We give some additional characters to the description furnished by Cooke (Fl. B. Pres. II, 295).

Stem sharply quadrangular, nearly glabrous (No. 1753) or with a few minute upwards directed bristles on the angles (No. 1752), reaching 12cm.

with a few sparsely divided branches from the base (No. 1753) or with dense, diffuse interlaced branches (Nos. 1742, 1745), the latter 15cm. high. Smallest specimen 1cm. high with only two flowers and very small leaves (No. 1751). Leaves generally strongly dentate, teeth variable in number (Nos. 1752,1753), or margin subentire (Nos 1754, 1755, 1756), or quite entire (No. 1751), broadly ovate or ovate elliptic. subobtuse, the lower sometimes narrowed into a petiole 7mm. long (No. 1749); margin generally minutely spinous-serrulate. Calyx 5-ribbed, in flower folded, in fruit expanded by the capsule, ribs with a few (No. 1753) or numerous (No. 1752), minute spinous serratures, sometimes the whole calix minutely stiff-hairy. Upper lip of corolla broadly ovate-oblong, with two large rounded lobes (No. 1753), or ovate-acuminate, lip shortly (No 1752) or deeply (No. 1755) bifid, or broadly ovate-emarginate (Wight Ic. t. 863). Colour of corolla: Purplish, tube darker outside, lobe nearly white with darker margin, with a transverse purple bar across mid lobe of lower lip (Nos. 1752, 1755), or corolla more or less uniformly purplish. Appendage on longer filament inserted high up (No. 1753) or near the base (No. 1752, 1755); it may be from very small, wart-like (No. 1753) to half as long as the part of the filament above it (Nos. 1752, 1755, and Wight Ic. t. 863), generally narrowly cylindrical with subclavate glandular tip, never subulate. Seeds ovoid, with a minute tail at one end, echinulate (No. 1753) or pitted (No. 1738), sometimes irregular (No. 1745).

The plant is very common, especially during the rains, but flowers at all times of the year.

Locality: Bombay Island (Nos. 1738-1743, 1745, 1752, 1756), Salsette (No. 1755), Khandala (Nos. 1744, 1746, 1747), Igatpuri (No 1748), Mt Abu (Nos. 1749, 1753), Madura District (No. 1750), Manantoddy, Malabar (No. 1751).

Vandellia hirsuta, Buch.—Ham.—This plant is rather difficult to recognize from the descriptions in Hooker's Fl. Brit. Ind. IV, 280 and Cooke's Fl. B. Pres. II, 295. We give the following additions and corrections: Stem acutely quadrangular, more or less succulent, especially during the rains. Sometimes erect, undivided, short, 1-3cm. glabrous (No. 1761) or with a few densely hirsute suberect branches from the base (Nos. 1758. 1759, 1760, 1763), or stems many, prostrate, reaching 15cm. dividing at the first node into 5 branches in one plane (No. 1762); branches often glandular upwards. Leaves minutely bristle-serrulate on the margin, which may be almost entire (No. 1758) or sinuate (No. 1761) or generally distinctly serrate-dentate (Nos 1762, 1763, 1764); sometimes they are glabrous or nearly so (No. 1761), sometimes hirsute on both surfaces (No. 1758), but in general only on the upper surface and on the nerves beneath (Nos. 1759, 1760): the last mentioned specimens have the largest leaves, 4 × 2cm. narrowed into a $2\frac{1}{2}$mm. broad petiole. Inflorescence racemose with opposite flowers, lowest pair often axillary (Nos. 1761, 1762), pedicels stout, flattened on the upper side, subglabrous (Nos. 1758. 1761), or hirsute and glandular (No. 1759) or slender and sparsely hairy (Nos. 1762, 1763). Calyx subglabrous (No. 1761) or with short stiff upwards directed bristles (Nos. 1758, 1759, 1762, 1763). Corolla from 5mm. (Nos. 1761, 1762) to 8mm. (No. 1758), upper lip about half as long as the lower, pale greyish-yellow or brownish, obscurely notched, margin finely irregularly serrulate; lower lip white or nearly so. 3-lobed, lobes obtuse, the middle one suborbicular; throat with some yellow pubescence inside. Anterior stamens with long arched filaments, visible from above outside the closed corolla, each with a small oblong sessile gland at the base; pollen globose. Stigma bilamellate, lobes serrulate. Capsule subglobose (No. 1758) or more elongated (No. 1760), glabrous. Seed shaped like a truncate cone, with a minute tail at one end, ribbed.

minutely echinulate (No. 1760), or cylindrical, longitudinally ribbed, obscurely rugose (Nos. 1758, 1762).

Localities: Bombay Island (Nos. 1757, 1760, 1761, 1762, 1763, 1764), Penn, Colaba District (No. 1758), Salsette (No. 1759).—It is fairly common about Bombay, flowering at all times of the year, but chiefly during the rains.

We have never found a plant with the corolla bluish-white as given by Hooker *ex* Griffith.

Vandellia laxa, Benth.—This species was found on the slope of the High Wavy Mountain, Madura District, alt. 3,000 feet (No. 359). Hooker makes it a variety of *V. scabra*, Benth. (Fl. Brit. Ind. IV, 281), and he is of opinion that it deserves not even varietal rank. He adds that the stem is dichotomously branched.

We think that *V. laxa*, first described by Bentham, should be retained as a distinct species. The inflorescence is different from that of *V. scabra*, and the fruiting calyx is about twice as long as the fruit.

Bentham (in DC. Prodr. X (1846), 414) describes the inflorescence of *V. laxa* in these words: "The racemes are slender, the pedicels elongate, remotely falsely verticillate. The racemes, especially the terminal one, contracted into a 4-6 flowered umbel; a branch arises below the umbel, which is again umbelliferous at its apex." This is exactly the mode of branching in our specimens.

We add the following characters in order to complete the description: Branches up to 25cm. long, angular, sparingly strigose-hirsute, very slender, internodes up to 4.5cm. long. Leaves up to 1cm. long and almost as broad; tip rounded, obtuse or subacute, margin coarsely serrate; upper surface and nerves beneath sparingly hirsute. Pedicels slender, strict, erect; reaching 12mm. in fruit. Corolla with a 3-lobed lower and emarginate upper lip; lobes of lower lip subequal, orbicular. Filaments compressed; anterior stamens with rather long filaments, which have rounded auricles at the base; posterior stamens included, filaments very stout, subulate; anther-cells subequal. Style glabrous, stigma bilamellate. Capsule subglobose about half the length of the enlarged strigose-hirsute calyx-segments which attain 5mm. in fruit. (*V. scabra*, Benth., has the capsule equalling the calyx-segments, Hook. f. Fl. Brit. Ind. IV, 281).

TORENIA, L.

Torenia hirtella, Hook. f., was found to be common on the High Wavy Mountain, Madura District, on the slope as well as on the plateau, 3,000-4,500 feet (Nos. 504, 1549, 1550).

In order to complete Hooker's description in the Fl. Brit. Ind. IV, 277, we add the following:—Branches diffuse, very slender, up to ½m. long, internodes up to 8cm. long. Leaf-margins and nerves below slightly strigose. Corolla pale lilac, each lobe of lower lip with a large purplish-blue spot, throat bluish. Stamens purple. The tooth at the base of the longer filament is as long as the filament itself, stout, cylindrical, obtuse, glandular.

The Fl. Brit. Ind. gives 2,000 feet as the maximum altitude for the species in Ceylon.

Torenia cordifolia, Roxb., seems to be rare in the Bombay Presidency. We have found only two specimens. One is from the Kanary Caves, Salsette, Aug. 1917 (No. 1551), the other from Kasara Ghats, Sept. 1917 (No. 1552). Both specimens have a lilac corolla, with the throat and midlobe of lower lip purplish.—Cooke, Fl. B. Pres., describes the leaves as glabrous, while Graham, Bot. Mag. t. 3715, has them hairy above, glabrous below. In our specimens they are distinctly hairy on both surfaces, on the lower surface chiefly on the nerves.

SUTERA, Roth.

Sutera glandulosa, Roth., is somewhat variable with regard to the colour of the corolla. Hooker (Fl. Brit. Ind. IV, 258) gives it as nearly white, while Cooke (Fl. B. Pres. II, 285) says it is white. We found the corolla white (Nos. 1605, 1606), and pinkish-white (No. 1607) in Khandesh along the Tapti river. In a specimen from Khandala, in a deep ravine, the corolla is white with a pink longitudinal line on midlobe of lower lip (No. 1608). The plant is not common and prefers sandy river beds.

MIMULUS, L.

Mimulus gracilis, R. Br.—Hooker (Fl. Brit. Ind. IV, 259) seems to be mistaken when saying that the calyx-lobes are rounded. Both Benth. (DC. Prodr. X, 369) and Cooke (Fl. B. Pres. II, 287), give them correctly as acute. Hooker says that the corolla is white or pale blue. We found the plant at Mt. Abu flowering in October (No. 1609), fruiting in May (No. 1610). The former specimen had a compressed corolla, 2-grooved on the lower side of lower lip, pinkish in colour and with brown spots on midlobe of lower lip. A flowering specimen from the Tapti river near Bhusawal (No. 1611), found in December 1916, has the corolla white with a pink tube and pink spots on lower lip. The plant does not generally turn blackish in drying, as Hooker has it. Our specimens show ciliolate corolla-lobes, thus agreeing with Bentham's, but not with Cooke's description.

MAZUS, Lour.

Mazus McCannii, sp. nov.—A small annual erect plant, either stemless with a scape 5-9cm. high or with a slender leafy stem, reaching 16cm. including the raceme, glabrous or minutely hispid, often glandular, simple or sparsely branched and with internodes 3½cm. long ; there are no runners rooting at the nodes, but sometimes a few branches at the base of the plant, resting on the ground, possibly developing into runners ; the leaves on these branches are opposite or alternate, subentire, subspathulate, 25 × 7mm., with petiole 15mm. long. The other leaves are either radical up to 42 × 18mm. or cauline and opposite, reaching 35 × 15mm., thin, obovate, narrowing into a petiole variable in length and keeled below ; margin obscurely crenate-dentate or sinuate, lower surface quite glabrous, upper with a few short soft bristles. Flowers about 10 in lax terminal or lateral racemes, the basal branches sometimes bearing a few flowers. Inflorescence acropetal. Pedicels distant, stout, alternate, up to 5mm. long in flower, 10mm. in fruit, glandular, ebracteate, 1-bracteolate, bractcole inserted about 1mm. up the petiole, subulate, the lowest (largest) 2·5mm. long, glabrous. Calyx in flower almost regular, 5mm. long, 5-lobed more than half-way down, in fruit much enlarged, 8mm. long, irregularly deformed, with spreading lobes. Lobes ovate-lanceolate, subacute, one-nerved. Tube obscurely 10-ribbed, ribs with minute glandular hairs. Corolla 8 or 9mm. long, tube 4·5mm., upper lip 2mm., external in bud, erect, pale lilac, triangularly ovate, tip elongate, bifid, lobes narrow, 0·5 mm. long, margin minutely serrulate ; lower lip nearly white, 6mm. broad , 3-lobed, lobes 1mm. long, rounded, midlobe the smallest, incisions in lower lip continued on the outer surface of the corolla by deep depressions which run down for some distance along the tube; corresponding with those depressions there are rounded ridges on the inner side with about 6 yellow transverse bands which are also visible from outside; in the lower part the ridges are minutely pubescent and have a number of long clavate scattered hairs. Stamens didynamous; filaments glabrous, inserted in the tube at about equal height, arched; anthers touching in pairs; longer filaments bent at the place where they leave the tube; anther-cells small, equal, muticous, diverging, distinct; pollen ellipsoidal white; shorter pair of stamens included. longer exserted. Style 5mm. filiform, glabrous; stigma large, bilamellate, one lobe larger, recurved, lobes oblong, papillose on their inner surface. Ovary ovoid, slightly compressed, glabrous. Capsule included in the calyx, loculicidally bivalved, compressed, obtuse. Seeds numerous, angular, slightly falcate, brown.

Locality: Victoria Gardens, Bombay, March 1917 (Nos. 1718, 1719,1766), flowers throughout the year; Igatpuri, September 1917, collected by Mr. C. McCann (Nos. 1720, 1721, 1722).

Stemless with radical leaves in the dry season, with elongated stem during the rains.

There is some probability that this plant is identical with Wight's *Mazus surculosus* (Ic. IV, iii, p. 1, t. 1407). Wight says that the drawing was sent to him by Edgeworth from Mussoorie. Now the calyx in Wight's figure comes very near that of our plant, but Wight says that the lobes are shorter than the tube. Hooker f. (Fl. Brit. Ind. IV, 260) puts Wight's plant under *M. surculosus*, Don, but with a sign of interrogation (the figure is wrongly cited as t 1467) and adds that "the figure in Wight's Icones represents the calyx very incorrectly." As a matter of fact, *M. surculosus*, Don, should have the calyx-lobes ⅓ the length of the tube. That Wight's drawing does not belong there is evident, and we have better reasons to include it under the new species, although we refrain from doing so for the present. It is not impossible that the slight differences will be found to be due to climatological factors.

Mazus rugosus, Lour.—Dalzell and Gibson (Bombay flora, 176) mention this plant as occurring in Thana, Salsette: "On garden-walks in the rains." Cooke (Fl. B. Pres. II, 310) excludes this species from the Bombay Presidency, on the ground that neither he himself nor any of the Poona plant-collectors have found it in Thana, although they have often searched for it. He mentions, however, that there is a sheet of Dalzell's in Herb. Kew with the note: "Found in a garden, but I do not think indigenous." It seems probable that, although no locality is given on the sheet in question. this was the identical plant referred by D. & G.

It appears that the distribution of the genus *Mazus* offers many points of interest. We should be much obliged for any communications regarding the occurrence of the species of *Mazus*.

LINDENBERGIA, Lehm.

Lindenbergia polyantha, Royle, should be reduced to *L. urticæfolia*, Lehm. There are apparently many doubtful points in the genus *Lindenbergia* which, in the course of time, must be cleared up. We are making an attempt with regard to the two species mentioned above.

Bentham (in DC. Prodr. X, 376) makes two subdivisions of the genus, one comprising the species with a hard, perennial or woody stem, the other with slender annual stems. In the latter division he places *L. urticæfolia* and *L. polyantha*. These subdivisions cannot be maintained. We have numerous specimens of *L. urticæfolia* which are woody below and in all probability perennial.

Our reasons for reducing *L. polyantha* to *L. urticæfolia* are these:

(*a*) No distinguishing character of value can be found in the various descriptions published.

(*b*) There is an unbroken chain of intermediate forms uniting the two old species. There are even specimens which, in their different parts, exhibit characters of both the old species.

(*c*) The various descriptions of the plants are often contradictory, which seems to indicate that the Botanists concerned found it difficult to sharply separate the two species. Bentham, *v.g.*, says that the corollas in both species are glabrous. Hooker f. (Fl. Brit. Ind. IV, 262) gives the corolla of *L. urticæfolia* as sparsely hairy, while Cooke (Fl. B. Pres. II, 307) states that both plants have a hairy corolla, and gives a detailed description of the epidermal appendages, with which our specimens agree. Similarly Bentham says that the ovary is glabrous in both, which is contradicted by Hooker and Cooke.

As regards *L. polyantha*, it does not even deserve varietal rank. Several of our specimens could, with much better reason, be regarded as belonging to distinct varieties; but as intermediate forms between them are likely to be obtained in future, we confine ourselves at present to enumerating the following forms:—

(1) The form as described by Cooke under *L. urticæfolia:* herbaceous, slender 10-20cm. high, stem brittle, villous. Leaves large, broad, up to 6×2·5cm. petioles up to 1·5cm. Serratures very coarse, absent in the lower part of the leaf. Flowers solitary, axillary, far apart. Locality: Bombay Island, common (Nos. 1562, 1563, 1564), Bassein (Nos. 1565, 1724), Cutch (No. 1566). Generally growing on walls.

(2) Small stunted half shrubby, woody below, stem brittle, branches villous. Leaves much smaller and closer together. Locality: Khandesh (No. 1567), Cutch (No. 1568). Generally growing on rocks.

(3) Large, much-branched, half shrubby, woody below, stem brittle, villous. Plant reaching 60cm. Leaves like form (1). Locality: Karanja Island (No. 1569), Road up to Mt. Abu (Nos. 1570, 1571). Generally growing on sandy soil, road banks, etc.

(4) Herbaceous, very slender, sparsely branched or with simple, flexuose, slightly hairy stem. Leaves similar to form (1), but glabrate, very thin, membranous. This is the common Mt. Abu form (Nos. 1572, 1573), generally growing in moist, stony places or on cultivated ground. Also found in Khandesh in the bed of the Tapti river (No. 1574).

(5) Stem slender, up to 15cm. simple, flexuose, pubescent, flower-bearing down to the ground; internodes short. Leaves (bracts) much smaller than in any of the preceding ones, but longer than the calyx, the longest attaining 15×5mm. with a petiole 6mm. long, pubescent; upper leaves elliptic-lanceolate, serratures shallow. Calyx in flower only 3mm. long, pubescent, enlarged in fruit. Corolla 6mm. Locality: Road up to Mt. Abu (No. 1575). Similar specimens with more or less branched stem from Igatpuri (No. 1576) and Cutch (No. 1577). Another specimen from Igatpuri (No. 1729) has leaves 25×9mm. with a petiole 7mm. long.

(6) Stem very stout, woody below, brittle, tubercled. Branches diffuse, villous, straggling. Leaves and bracts sparsely hairy, ovate-elliptic, reaching 7×2cm. narrowed into a pubescent petiole 2·5cm. long. Serra, tures close, absent in the lower third of the leaf. Calyx 7mm. in flower-pubescent. Corolla about 15mm. long. Locality: Khandesh, bank of the Tapti river (No. 1578). A much more slender specimen of a similar habit from the same locality (No. 1579).

(7) A minute, extremely slender, slightly hairy plant, stem not brittle, reaching 3cm. high. Leaves 2-3 pairs attaining 15 × 9mm., broadly ovate with a few large teeth, very thin, membranous, glabrate. Petioles up to 6mm., capillary. Flowers few, sub-terminal or in all the axils. Calyx 3mm., corolla 5mm. Locality: Mt. Abu (No. 1580), growing on moist rocky ledges, in shade.

(8) This is the form described by Cooke under *L. polyantha*. It is generally much branched, chiefly from the base, which is often woody, with long brittle branches, forming densely leafy racemes or spikes. Leaves (bracts) not much exceeding the calyx. Whole plant densely villous. It is a common form. Locality: Bombay Island (No. 1581), Bassein (No. 1582), Khandeish (No. 1583), Cutch (Nos. 1584, 1585, 1586.) The more southern specimens have longer, more slender branches than the others, which are more robust, stunted.

(9) An intermediate form between form (1) and form (8), with a woody base and diffuse, brittle branches, densely villous. The lower leaves are like those of No. (1), reaching 3cm., but with closer serratures. The leaves of the inflorescence are like those of No. 8. Locality: Khandesh, Bori river (No. 1587).

(10) Another intermediate form between (1) and (8), showing just the opposite arrangement of the leaves. Locality: Bombay Island, Fort (No. 1588), on the wall of a tank in exactly the same spot as No. 1581. The latter specimen was obtained in February, the former in June. The plant is 40cm. high with ascending brittle branches, which in their lower part have got leaves like those of form (8) while they are terminated by a tuft of leaves like those of form (1) but sometimes smaller and with a shorter petiole.

Forms 1, 2, 3, 6, 8, 9, 10 become black in drying, the others keep their green colour. It is worth noting that those forms which dry black are also more or less brittle, whilst the others are not. This may possibly prove to be a constant character.

DOPATRIUM, Buch.-Ham.

Dopatrium junceum, Buch.-Ham. var. *multiloba*, var. nov.

Characters of the type, except for the following: A small plant, 11cm. high, calyx 2·5mm. long, 5-or 6-fid to below the middle, lobes linear-oblong obtus. Corolla 7 mm. long; upper lip entire, 2mm., square. Lower lip with 5 (in one flower) or 7 (in two flowers) lobes, incisions very variable and in the three flowers observed in no way uniform. The lobes are linear oblong, ounded at the tip. Colour of corolla lilac, with purple veins (not pinkish violet). Locality: Igatpuri, in a rice-field, January 1917 (No. 1597).

Dopatrium junceum, Buch.-Ham.—We make a few corrections and additions to Cooke's description (Fl B. Pres. II, 293).

Pistil green. Stigma broad, almost flat on top (certainly not bilamellate). Seen from above it is oval in outline. Anthers yellow. Fleshy hairs in the tube near the base of the stamens and staminodes. Seeds ellipsoid, very strongly longitudinally ribbed, transversely rugose (not tuberculate). Locality: Bombay Island (No. 1589), Salsette (No. 1590), Igatpuri (No. 1591), Mt. Abu (Nos. 1592, 1593, 1594, 1595, 1596).

Dopatrium lobelioides, Benth. As to wrong reference in Hook. f. Fl. Brit. Ind. see under *Ilysanthes*.

SCOPARIA DULCIS, L.

It is interesting to note the great rapidity with which this Tropical

American plant has spread over large areas of British India. Hooker (Fl. Brit. Ind. IV, 1885, 289) says : "Though now a superabundant Bengal plant according to Mr. Clarke, it was unknown in Roxburgh's time, and occurs in no Indian Herbarium except Clarke's. Voigt mentions it (1845) as found about Serampore, whence probably it has spread quite recently." Dalzell and Gibson in their Bombay Flora (1861) do not mention the plant. Woodrow (Journal Bombay Natural History Society, XII, 175) obtained it in a salt swamp, Bombay, Nov.-Cooke (Fl. B. Pres. II, 1908, 310) mentions this, but adds that he has not seen Woodrow's specimens. At present the plant is to be found all over Bombay Island, as the following list of localities shows.

Mazagon, Aug. (No. 1555), Mahim, Nov. (No. 1556), Matunga, September (No. 1557), Sion, November (No. 1558), Fort, November (1559), August (No. 1560). Of other localities we mention Manantoddy, Malabar, November (No. 1561), Kambam, Madura Distr., May (No. 498). The specimen from Kambam is quite shrubby.

VERONICA, L.

Veronica anagallis, L.—Hooker (Fl. Brit. Ind. IV, 293) and Cooke (Fl. B. Pres. II, 301) describe the seeds of this plant as bi-convex. In all our specimens which without doubt, must be referred to this species, the seeds are plano-convex. We have specimens from Mt. Abu, taken in May and October 1916, (Nos. 1623-1629) and from Khandesh, Tapti river, taken in Dec. 1916 (Nos. 1620, 1621, 1622). In both localities the plant is common.

In addition to the typical plant we found two of the varieties given in Hooker of which we wish to complete the descriptions, and two other varieties which have not been described as yet.

Var. *punctata*, Hook. f. Fl. Brit. Ind. IV, 293.—The specimens collected by us attain 7cm., the leaves are all petioled, up to 13 × 6mm. elliptic, oblong or sub-spathulate, lower sometimes obscurely serrate, the upper entire. Pedicels 5-10mm., bracts 2mm., linear, lowest pair often larger, leaf-like. Locality Mt. Abu, Oct. 1916 (No. 1631).

Var. *montioides*, Boiss.—Very small (3cm.), stem with a few branches, leaves and bracts uniform, 2mm. long, elliptic-oblong ; pedicels about twice as long ; flowers few. Locality : Mt. Abu (Uria), May 1916 (No. 1632).

Var. *bracteosa*, var. nov.—Stem about 6cm. high, rather stout, with a few spreading short branches at the base. Internodes few. Leaves longer than the internodes, oblong, sessile, 3·5 × 1·5cm. subserrate, obtuse. Racemes axillary, many flowered, shorter than the leaves ; peduncles 1·7 cm. ; bracts twice as long as the pedicles, elliptic, or oblong, subacute attenuate at the base, reaching 5 × 1·5mm. Locality : Mt. Abu (Uria), Oct. 1916 (No. 1633).

Var. *calycina*, var. nov.—Stem about 6cm. high, rather stout, with a few slender branches, below. Leaves attaining 3 × 1cm., elliptic or obovate attenuate at the base, irregularly toothed, tip rounded. Racemes from nearly all the axils, very much elongated, lax, the lowest reaching 11cm. and thus by far overtopping the stem, many-flowered. Bracts generally a little longer than the pedicels, linear-oblong, attenuate at the base, acute, entire. Calyx-lobes much enlarged in fruit, attaining a length of 4mm., one pair 2mm. broad ovate, generally enclosing the capsule, the other pair 1mm. broad, spreading, shaped like the bracts ; all lopes are obtuse or subacute. Locality : Khandesh, Tapti river, Dec. 1916 (No. 1634). One specimen only.

Veronica beccabunga, L.—The specimen has been sent from Chamba (No. 1635).

Veronica beccabunga, L. var. *attenuata*, var. nov.—The plant is robust, up to 20cm. high, with thickened nodes, the lower of which are rooting. The leaves are large, from broadly ovate (7×3·5cm.) to ovate-elliptic (7×2·5cm.), very coarsely dentate or serrate, 3-nerved, attenuate at the base into a petiole about 1 cm. long. Loc. Uria (Mt. Abu), May 1916 (Nos. 1636, 1637). The specimens were not in flower.

Veronica deltigera, Wall.—We have specimens from Chamba (Nos. 1638, 1639). The latter specimen has the leaves distinctly petioled; petiole about 1mm. long; in the former the leaves are sessile, agreeing with Hooker's description (Fl. Brit. Ind. IV, 292).

SOPUBIA, Buch.-Ham.

Sopubia delphinifolia, G. Don.—This plant is very variable. We shall give an account of some of the forms observed. They pass into each other and it is not possible to make distinct varieties.

(1) Height 16cm.; stem with two branches, 3cm. from the root, itself continuing only two cm. from the node, flowerless. Leaves simple or nearly so, linear, up to 25×1mm., margins strongly puberulous. Plant not hairy. Pedicels 5mm., bracteoles 3-4 mm. Calyx up to 1cm., lobes narrowly subulate as long as or longer than the tube. Corolla 22mm. long, rose-purple. Loc. Mahim, Bombay Island (No. 1767). Similar specimens, but with slightly more divided leaves and larger calyx were found in Khandesh (Nos. 1768, 1769).

(2) Plant reaching 1m. in length. Stem stout, woody below. Branches erect, slender. Leaves very numerous, profusely divided; lobes very long and narrow; margins slightly puberulous, as are also the bracteoles and calyx, which otherwise are similar to those of (1). Pedicels 3mm., stout. Corolla rose, with large pink-purple spot in throat (1732).

Loc. Bassein (No. 1732), Salsette (No. 1770), Bombay Island (Nos. 1771, 1772), Trombay (No. 1773). The last specimen less luxuriant.

(3) Stem stout, woody, below, nearly 1 m. high. Leaves comparatively few, almost absent below for about 25cm., and also on the inflorescence, which gives the plant a habit different from that of (2), much divided, margins slightly puberulous. Pedicels 6mm., bracteoles up to 5mm. Calyx 8mm., lobes broad at base, generally shorter than the tube. Fruiting calyx much enlarged, distinctly ribbed; tube 7mm. long, lobes deciduous. Corolla 20mm., long, rose-purple.

Loc. Bhandup, Salsette, (No. 1774).

(4) Stem about ½m high, slender, leafless only at the base. Branches arising from about the middle of the stem, ascending. Leaves like those of (2), but smaller, and fewer, not so much divided. Pedicels reaching 8mm., slender.; bracteoles 7mm; corolla 15mm. long.

Loc. Khandala (No. 1775).

(5) Stem reaching 20cm. slender, slightly hairy, simple, or with a few short branches. Leaves numerous, much smaller than in (4), much divided, crowded; margins of leaves and lobes of calyx puberulous; pedicels and bracteoles 3mm. Calyx divided half-way down, 5-6mm. long. Corolla 12mm. long.

Loc. Panchgani on Table Land (No. 1776).

(6) Stem very slender, 20cm. high, simple or sparsely branched. Leaves hardly exceeding 1cm., generally trifid and like the calyx-lobes much puberulous. Pedicels 3mm.; bracteoles 2-3 mm. Calyx in flower 4mm., in fruit 7mm. Lobes hardly as long as the tube, narrow.

Loc. Igatpuri (No. 1777).

(7) Stem scarcely branched, 40cm. high, pubescent below. Leaves numerous, short, 2cm. long, puberulous. The upper leaves with many narrow lobes, those near the base of the stem with few much broader (2mm.) lobes with obtuse tips. The change between the upper and lower leaves rather sudden. Pedicels and bracteoles 5mm. long.

Loc. Brahmagiri, alt. 4,000-5,000 ft. (No. 1778).

(8) A small plant, reaching 15cm., with flexible stem, naked in its lower half, profusely branched in the upper. Leaves very small, rarely reaching 1 cm., linear-entire or nearly so. Flowers numerous, small; pedicels 2-4 mm.; bracteoles 3mm. Calyx in flower 6 mm., in fruit somewhat enlarged; lobes narrow, only half as long as the tube.

Loc. High Wavy Mountain, Madura Dist. (No. 503). On dry grassy hillsides, alt. 4,000 ft.

(9) A small plant, 16 cm. high, branched from the base; branches slender, erect. Leaves up to 15mm. long, narrowly linear, entire or with two lobes at about the middle, 7mm. long. Pedicels reaching 6mm. Calyx lobes subulate, shorter than the tube in flower, as long as the tube in fruit.

Loc. High Wavy Mountain, Madura Dist. (No. 1782). One specimen on dry grassy hillside, alt. 4,000 ft.

The species has been found in flower in the month of May in the Madura Dist. About Bombay it flowers from August to January.

Sopubia trifida, Buch.-Ham. This species, too, is a variable plant. We note the following forms:

(1) Short, stout, slightly pubescent, little divided. Pedicels 9, calyx 7, corolla 10mm. long. Floral leaves linear, twice as long as the pedicels, puberulous and hispid, entire or trifid, bracteoles reaching 9mm. in length.

Loc. Panchgani (No. 1783).

(2) Plant 30cm. high, branched from about the middle. Leaves generally linear entire, puberulous and hispid, the floral ones as long as or slightly longer than the pedicels which attain 10 mm. in fruit. Bracteoles reaching 4 mm.

Loc. Poolachee (No. 1784).

(3) A much larger plant, reaching 80 cm. Stem stout, woody below, much branched from about the middle. Lowest leaves very few, sometimes lanceolate-acute, $12 \times 2\frac{1}{2}$mm., leaves near the middle of the stem, numerous, up to 30mm. long, generally much divided, puberulous and hispid. Floral leaves linear-entire, some much longer, but some also shorter than the pedicels which attain 10mm. in fruit. Bracteoles about 3mm. long. Calyx 5, corolla only 5mm. long, yellow, throat with a purple spot. Stamens purple.

Loc. High Wavy Mountain, Madura Dist. (Nos. 262, 1785, 1786), on dry grassy slopes, alt. 4,000 ft., fairly common.

We have always found that the bracteoles are opposite, not alternate as stated by Cooke (Fl. B. Pres. II, 306).

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. BELL, I.F.S.

(*Continued from page* 672 *of Vol. XXIV.*)

PART XIX.

3. Genus—MEGISBA.

There is only one species of the genus, *Megisba malaya*, the one described below. The distribution is given under the description. It is rather like *Neopithecops zalmora* in appearance and markings, but differs in the shape of the wings; the hind wing may be with or without a tail.

129. Megisba malaya, Horsfield.—*Wet-season brood.*—Male and female. *Upperside*: from dull somewhat pale brown to dark brown, some specimens nearly uniform, others with a more or less distinct, pale, discal patch on fore wing. Hind wing: uniform; a slender, short, filamentous tail at apex of vein 1, very often absent. *Underside*: white. Fore wing: with the following brown markings:—a spot in the cell, a transverse, short line on the discocellulars, a postdiscal, curved series of transverse spots or very short bars that cross the wing from costa to dorsum and are in irregular echelon one with the other; followed by a slender, transverse, broken line; a subterminal series of broader, transverse spots and an anteciliary, slender line; at apex of wing the markings are diffuse and form a very small, brown-shaded patch while, further inwards, along the costa, veins 11 and 12 terminate in a minute, brown dot, and there is another further in above vein 12. Hind wing: three spots near base in transverse order; a large, conspicuous, rounded, subcostal and a small, similar spot near the middle of the dorsum, black; between the latter two: a thin line along the discocellulars and five irregular, much paler brown, transverse, serial spots and dashes which are followed, as on the fore wing, by an outer postdiscal, very slender, brown (here lunulate) line; a subterminal series of brown or black spots and a black, anteciliarly line. *Cilia* of fore and hind wings white, turning to dark brown at apex of fore wing. Antennæ, head, thorax and abdomen dark-brown, the antennæ ringed narrowly with white; beneath: palpi, thorax and abdomen snow-white; the third, slender, acicular joint of the palpi conspicuously brown; antennal club tipped chestnut.

Dry season brood.—Male and female. Very similar to the wet-season brood, but the fore wing, on the upperside, bears a large, oval, obliquely-placed, conical, white patch that extends from the middle of the dorsal margin to vein 4. In certain specimens this white bar or patch is continued on to the hind wing. *Underside*: similar to that of the wet-season form but all the markings broader, coarser, more prominent. Fore wing: costa and apex in some specimens broadly shaded with diffuse fiscous brown; the outer, postdiscal, brown line formed into a series of lunules that extend outwards, slenderly, along the veins and join the anteciliary brown line, thus enclosing, in the interspace, a series of spots of the white ground-colour, each of which is centred with a black, or dark brown, subtriangular spot.

Hind wing: terminal markings modified as on the fore wing; the spot in interspace 8 of the subterminal series larger and more prominent than the others, the larger, subcostal, black spot often broken by an anterior and a posterior silvery spot superposed on it. Antennæ, head thorax and abdomen as in specimens of the wet-season brood but slightly darker above. Expanse: male and female, 23-33 mm.

Larva.—Of the tailless form *thwaitesi* in Ceylon, as described by Moore in his Lepidoptera of Ceylon, he gives the description as "light green, vermi-form, middle segments swollen." Not very lucid.**

Pupa.—"Thick, blunt at the ends." From the same author.

Habits.—The butterfly is very similar to *Neopithecops zalmora* and is very difficult to distinguish from that species when on the wing, frequenting as it does similar localities in the evergreen jungles and their outskirts, flying low near the ground amongst vegetation and having the white undersides which make that species so easy to see when flying. The flight is, perhaps, more rapid than that of *N. zalmora* and the insect is, certainly, far less common. The larva is said by Moore to feed upon *Sapindaceæ*, (probably *Hemigyrosa*, *Erioglossum*, *Schleichera*, *Harpullia*; all, with the exception of *Erioglossum*, common trees of the Ghats in Bombay). The butterfly has a wide distribution which Colonel Bingham gives as "the Hymalayas from Kumaon to Sikkim; Peninsular India; Calcutta, Orissa, Ganjam, Poona, the Nilgiris, Travancore; Ceylon; Assam; Burma; Tenasserim; Andamans; Nicobars; extending far into the Malayan Sub-region." To this may be added, under Peninsular India, the Districts of Belgaum and Kanara along the Western Ghats in the Bombay Presidency.

4. Genus—LYCÆNOPSIS.

This genus was formerly known as *Cyaniris*. It is nearly allied to the genus *Lycæna*, the largest in the whole family of *Lycænidæ* and more or less palæarctic. Some 20 species of *Cyaniris* occur within Indian limits if we include under that term Ceylon, the Nicobars, the Adamans and Burma. Only four of these are noticed here. The Holly Blue of England is *Cyaniris argiolus*, the only representative of the genus to be found there.

130. Lycænopsis akasa, Horsfield.—Male. *Upperside*: fore wing: black; a medial triangular area that extends from base outwards to the disc white, suffused at base and anteriorly with iridescent blue that spreads upwards on to the black of the costa; along the dorsum the black ground-colour is much paler, in most specimens diffuse fuscous. Hind wing: white, basal third and costal margin broadly suffused with fuscous, the fuscous at base posteriorly overlaid with iridescent blue; a subterminal series of fuscous-black dots and a distinct but very slender, black anticiliary line. *Underside*: white, very slightly tinged with bluish; markings all fuscous-black, minute and very slender. Fore wing: a short, discocellular line followed by an anteriorly strongly curved, discal series of very short, detached lines and a more or less obsolescent, transverse series of subterminal dots. Hind wing: three subbasal dots in transverse order; a short

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** NOTE:—Since writing this, three specimens of the butterfly have been bred from larvæ found in Kanara on flower-spikes of *Allophyllus lobba* in company with those of *Nacaduba ardates* from which, however, they were unfortunately not distinguished.

line on the discocellulars ; a spot below the middle of the costa with a smaller spot below it ; a posterior, discal, irregular, sinuous series of five or six minute spots and a perfectly regular subterminal series of similar spots. *Cilia* of both fore and hind wings white. Antennæ, head, thorax and abdomen blackish, the antennæ ringed with white ; beneath : the palpi, thorax and abdomen snow-white.—Female. Very similar. *Upperside*: the white area much more extended on both fore and hind wings. On the former it spreads well into the cell, on the latter three-fourths of the wing are white ; the dusky basal and costal areas much more restricted than in the male. The iridescent blue suffusion is in many specimens entirely absent, in a few very faintly indicated ; the subterminal series of black dots so distinct in the male are generally faint and obsolescent. *Underside*: as in the male but the markings less distinct. Antennæ, head, thorax and abdomen as in the male. Expanse ; male and female, 28-29 mm.

Larva and *Pupa*.—The life history of the species, as far as in known, has not been discovered.

Habits.—Likewise unknown ? Nowhere are they described. The species has been included because it is fairly common where it exists and may occur occasionally in the Plains of Southern India. It is found in the Nilgiri, Anamalai and Pulni Hills of that region ; Ceylon ; extending to Java.

131. Lycænopsis albidisca, Moore.—Male and female. Very closely allied to *C. puspa*, from which it differs as follows :—Male. *Upperside*: dull indigo-blue, not so dark as *puspa* when looked at from above vertically and with much less refulgent iridescence in an oblique light ; the white on both fore and hind wings much more clearly defined, never diffuse and apparently present at all seasons : on the fore wing the white is limited to the basal portions of interspaces 2 and 3 and does not extend into the cell or above vein 4 ; on the hind wing it occupies the basal half of interspace 6 and is strictly bounded by vein 7 above and vein 6 below. The terminal margins of both fore and hind wings with much narrower black edgings than in *C. puspa*. *Underside*: differs from that of *puspa* in the markings, which are smaller and much more delicate ; on the fore wing the transverse, postdiscal series of abbreviated, line-like markings is bisinuate, placed further towards the terminal margin and has the component spots somewhat differently arranged ; on the hind wing also the spots on the disc posteriorly are more regular than in *puspa*.—Female. *Upperside*: ground-colour and white on disc of wings almost as in *puspa*, but always both in fore and hind wings more limited, the black costal and terminal margins consequently broader. *Underside* : the markings as in the male, and therefore differ in a similar manner from those of *C. puspa*.—Female. Antennæ, head, thorax and abdomen in both sexes as in *C. puspa*. Expanse : male and female, 34-39 mm.

Larva and *Pupa*.—Unknown.

Habits.—They are not likely to differ much from those of *L. puspa*. The butterfly is very like that species. It occurs in the hills of Southern India from 2,000 to 6,000 feet.

132. Sycanopsis limbata, Moore.—Male. *Upperside*: uniform dark purplish-blue. Fore and hind wings : termen narrowly edged with black ; costal margin of hind wing more broadly fuscous black. *Underside* : white with a light greyish-blue tint ; markings for the most part pale brown, disposed much as in *C. puspa*, smaller, more slender ; the transverse, discal series of abbreviated lines or elongate spots on the fore wing more regular, the spots more evenly *en échelon*, the spot nearest the costa small and shifted well inwards. Hind wing: the black, subcostal spot in the middle of interspace 7 subbasal, not larger than the three subequal spots: the posterior discal series of spots bisinuous, none conspicuously larger than the others. Antennæ, head. thorax and abdomen fuscous black, the antennæ ringed with white, the head and thorax clothed above with long bluish hairs; beneath: the palpi, thorax and abdomen greyish white.—Female. *Upperside*: fore wing: bluish purple, paler outwardly, in certain lights with a resplendent iridescence; costa and apex very broadly, termen somewhat more narrowly fuscous black. Hind wing: as in the fore wing iridescent bluish purple but uniform not paler outwardly; the costal and terminal margins broadly and evenly fuscous black, this border on the termen with a series of superposed, blue lunules. *Underside*: ground-colour and markings as in the male. Antennæ, head, thorax and abdomen similar to those of the male but the thorax and abdomen above not so dark. Expanse: Male and female, 32-36 mm.

Larva and *Pupa*.—Unknown.

Habits.—Unknown. Occurs in the hills of Bengal; Southern India; Bombay on the Western Ghats, the Nilgiris, Anamalai and Palni Hills; Ceylon; the hills of Assam. The species is fairly plentiful locally in the Ghat parts of Kanara District in Bombay.

133. **Lycænopsis puspa, Horsfield.**—*Wet-season brood.*—Male. *Upperside*: violaceous blue, with brilliant iridescent tints in certain lights. Fore wing: the costa, apex and termen bordered with black, this edging narrows from base to the middle of the costa, then broadens greatly at apex, where it occupies the apical fourth of the wing, and is again narrowed below vein 4, whence it is continued as an even band to the tornus; on the disc beyond the apex of the cell the ground-colour is sensibly pale and the dark markings of the cell are faintly visible by transparency from below. Hind wing: the costa very broadly, the termen much more narrowly black; the black bordering on the latter consists of a series of rounded coalescent spots, which on the inner side are margined by faint dark lunules; these are formed not by actual scaling but by the dark markings of the underside which show through more or less clearly. *Underside*: slightly bluish white: the markings, some black, some dusky, but all large and distinct. Fore wing: a short bar on the discocellulars, an anteriorly inwardly curved, transverse, discal series of seven, more or less elongate spots, of which the spot in interspace 2 is vertical and sinuous, the next above it irregularly oval and obliquely placed, the next smaller and almost round, the fourth placed almost longitudinally, forms a short bar, and the apical three decrease in size to the costa: beyond these is an inner subterminal, transverse, lunular line, an outer subterminal series of transverse spots and a very slender anticiliary line. Hind wing: two basal and three subbasal spots in vertical order: a line on the discocellulars; a spot above it at base of interspace 6; a much larger spot above that in interspace 7; a lower discal irregular transverse series of five spots, followed by terminal markings similar to those on the fore wing, except that the spots in the subterminal row are rounded, not transverse. *Cilia* of both fore and hind wings white alternated with dusky black at the apices of the veins. Antennæ, head, thorax and abdomen dusky black, the antennæ ringed with white and tipped with orange; beneath: the palpi, thorax and abdomen white.—Female. *Upperside*: white, the bases of the wings and in some specimens the hind wing posteriorly shot with iridescent blue. Fore wing: costa, apex and termen broadly black; the discocellulars marked with a very short, fine black line that extends down from the black on the costal margin. Hind wing: costa

and apex broadly black; termen below vein 6 with a regular subterminal series of black spots in the interspaces, enclosed within an inner lunular and an outer straight, slender, anticiliary, black line; the veins, except vein 5 in the middle slenderly black. *Cilia* of both fore and hind wings white. *Underside*: ground-colour and marking similar to those of the male. Antennæ, head, thorax and abdomen as in the male.

Dry-season brood.—Male and female. Differs very slightly from the wet-season brood. In the male there is a small patch of white on the upperside of the fore wing beyond the cell and on the upperside of the hind wing on the anterior portion of the disc: the extent of this patch varies on the fore wing from a mere touch of white just beyond the cell to a large discal area of white which is diffused with ill-defined margin. In the female the blue iridescence at the base of the wings on the upperside is in some specimens considerably restricted, in others entirely absent. On the underside in both sexes the ground colour is paler and in form and position the markings are much less prominent, though entirely like those of the wet-season brood. Expanse: Male and female, 32-35 mm.

The terminal, black spots of the hind wing may be enclosed in what amounts to a terminal, black band.

Larva.—The shape is normal. The head is hidden under segment 2 and is shining, translucent light yellow in colour with brown suffusion about the jaws. Segment 2 is narrow, shortly parabolic in shape, somewhat narrowly square in front, slightly constricted laterally behind, indented slightly just in front of spiracle and with the horizontal top with the usual, dorsal depression; segment 3 is somewhat suddenly higher than segment 2, has an indentation on its vertex in dorsal line anteriorly besides a small, lateral indentation of the same sort and has the front margin waved gently; the margins of the succeeding segments are straight; segments 4 to 9 are equal in height to each other, the succeeding segments slope gradually to anal end; anal segment rather broad, trapeze-shaped, the somewhat broadly square hinder extremity being very slightly concave; the variation in breadth throughout the whole length of larva is very small, though the middle is, on the whole, the broadest part; the dorsal line is convex, the slope from it laterally, on the whole, straight on each side; the dorsal, transverse gland on segment 9 is mouth-shaped, broad; the organs on segment 12 are small, circular, white; segment 11 somewhat suddenly lower than segment 10. The surface of the larva is densely covered dorsally with tiny, cylindrical, white, star-topped tubercles or thickened hairs, each surmounted by a little golden, blunt hair which is bent down against the body; laterally and along the margin, these little golden hairs are sharp-pointed and more erect; the bottom of the depression on dorsum of segment 2 is covered with minute, red tubercles; the anal segment is covered with larger, white, star-topped tubercles than the rest of the body with similar appressed hairs; there are a few longish, fine, light hairs round posterior margin; there is, also a lateral, depressed, longitudinal line on each side of the anal segment which leave the dorsum and margins rather prominent. Spiracles are flush, nearly circular in shape, of ordinary size and wihte in colour. Colour of larva is a fine plum-pink with dorsal and spiracular, longitudinal lines the whole length of body; segments 11-14 dorsally green-yellow; there are indistinct, diagonal, lateral, white lines, one to each segment. L: 11 mm; B: 3. 75 mm; H: 3 mm.

Pupa.—The pupa is also normal in shape. The head is bowed and hidden from view when looked at from above; segment 2 is square in shape, nearly as broad in front as behind and as the breadth at shoulders, convex dorsally and laterally, very slightly laterally constricted at hinder margin, ascending towards thorax; thorax with its anterior, dorsal slope in the same plane as that of segment 2, roundly convex in its posterior part, slightly flattened laterally on the sides and there is very little constriction behind thorax; the abdomen is circular in transverse section stout, thickest about segment 8, the end rounded with the last segments sloping perpendicularly to the longitudinal axis of pupa: the last segments turned under, in no way prominent. Surface very finely aciculate, shiny, covered all over with short, erect, light hairs that are longest on segments 2 and 14; wings naked, slightly striate. Spiracles of segment 2 indicated by little linearly oval, white risings between the segment margins; the rest of the spiracles flush, oval, small, white. Colour of body is pinkish white, the thorax and segment 2 translucent-looking; blotches of yellow-red dorsally on anterior segments of abdomen; a blotchy, black, dorsal line the gland, a blotchy, lateral mark on segments 8, 9, hinder slope of thorax, and dorsum of segment 2 also black; a black spot on shoulder, two conjoined, black spots laterally on segment 4 and a lateral row of tiny, black dots on abdominal segments; thorax head and wings dotted all over with black. L: 7. 5mm.; B: 3. 2mm. H: 3. 2mm.

Habits.—The eggs are laid singly on the young parts of the plant: flowers, shoots, leaves; the larva lives generally on the undersides of the young leaves and is nearly invariably attended by ants. The pupation takes place anywhere: on a leaf or stalk, in a crevice, &c., in the open; and the attachment is normal, *viz.*, by the tail and a body-band. *L. puspa* is probably the most common of the genus in India. De Nicéville says: "except in Sikkim, where the changes of season are very great, it is fairly constant" in markings. "It is somewhat rare in the outer ranges of the Western Himalayas, becoming more plentiful eastwards; in Sikkim it is one of the very commonest 'blues' met with. It occurs eastward as far as Sibsagar in Upper Assam, also in Burma and in the Andaman Isles. On the continent I have taken it in Beerbhoom District; it occurs at Parsinath, at Khandalla on the Western Ghats, in North Kanara, in Orissa, Ganjam, in the Nilgiris, Ratnagiri, Cannanore and in Ceylon." It is a low flying butterfly, but fairly strong on the wing, fond of sitting on the ground to suck up moisture in damp places and on the leaves of low plants or on trees near the ground. It is not exactly an insect of the Plains, but has been taken out in the open fairly far away from the Ghats in Bombay. Neither is it an inhabitant of deep, shady, big jungles, preferring the clearings, sides of roads and open hill-tops to ravines and damp places. It is fond of the sun and the female may be found laying eggs on *Cylista scariosa*, a leguminous, trailing, thin-stemmed plant with yellow, papilionaceous flowers which is common by the sides of roads and in hedges. She walks about the flower-heads when in bud and lays the eggs singly in the axils of the stalks and bracts. The larva has also been found on the young, red leaves of *Hiptage madablota* (*Combretaceæ*, *Schleichera trijuga* (*Sapindaceæ*) and of the leguminous *Xylia dolabriformis*, both trees. It is only sought after by ants in a perfunctory manner, although, in the case of *Cylista* at least, there are nearly always some of these insects on and among the flower-heads. Colonel Bingham gives the distribution as Peninsular India, except in the desert tracts; Ceylon; Assam; Burma; the Andamans; extending into the Malayan Sub-region. Some of the wet-season males are intensely brilliant with very little white on the disc above.

134. Lycœnopsis lilaces.—Male. *Upperside*: shining purplish-black. Fore wing: costa narrowly and evenly for three-fourths of its length from base, apex broadly and terminal margin decreasingly jet-black: *cilia* black. Hind wing: costa and apex broadly, termen narrowly, bordered with black: a subterminal series of small, round, black spots that merge anteriorly into the black at apex; *cilia* black, tipped with white. *Underside*: opaque chalk-white. Fore wing: the following black markings:—a broad, short bar on the discocellulars; a discal, transverse series of prominent spots in interspaces 1 to 6, the spot in interspace 1 elongate, in 2 and 3 oval and placed obliquely on the wing, in 4 elongate and pointing obliquely outwards, in 5 and 6 rounded, the spot in interspace 6 shifted a little inward; beyond these discal markings is a transverse series of slender, black lunules, followed by a subterminal series of minute, round, black spots, one in each interspace and a very slender, anticiliary, black line; *cilia* on the underside white. Hind wing: also with the following black markings:—a minute spot at base, followed by two larger spots one above the other, a sinuous, short line on the discocellulars, and just beyond it a transverse, somewhat curved series of four slightly quadrate spots, two subcostal and two posterior: a discal series of four more spots, the lowest one curved, the next spot round, the next elongate and placed pointing obliquely outwards; lastly the apical spot of the series round; terminal markings and *cilia* as on the fore wing. Antennæ, head, thorax and abdomen black, the antennæ ringed with white and a white line along the inner and outer orbits of the eyes; beneath: the palpi thorax and abdomen white. Female. *Upperside*: brownish-black Fore wing: from base for a little more than two-thirds of its length and from the posterior half of the discoidal cell to the dorsum white, beautifully glossed with purplish blue at the upper outer corner of the area indicated above, which is pure white. Hind wing: glossed with blue over a broad, central area from base to a broad, brownish black, terminal border, on the inner margin of which and partially coalescing with it is a transverse series of large, round, jet-black spots, inwardly narrowly and obscurely margined with bluish white, this colour at the anterior spots carried as streaks inwards for a short distance. *Underside*: as in the male. Antennæ, head, thorax and abdomen also similar. Expanse: male and female, 36·38 mm.

Larva and *Pupa*. -Unknown.

Habits.—Unknown. This butterfly has only been recorded from the Nilgiris but might possibly occur in the Western Ghats of Bombay. De Nicéville looked upon it as a variety of *L. puspa*, but Colonel Bingham has recognised it as a separate species.

5. Genus—Zizera.

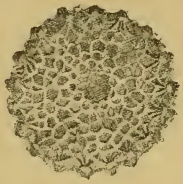
The genus is spread over nearly the whole of Europe and Asia and is found also in North and South Africa. It contains some of the smallest species of butterflies known, *Z. gaika*, measuring sometimes little over half an inch in expanse of wing. In India there are four well distinguished species. They are all widely spread and may be found in grass-lands everywhere from sea-level up to, in the case of *Z. maha*, 9,000′ elevation. The known distribution of each species is given under its description. They are all four liable to variation according to season and, in consequence, many varieties have been at different times wrongly described as good species. At home we have the genus represented by the Small Blue, *Z. minima*, the larva of which feeds upon vetches as do those of two of ours, *lysimon* and *otis*. The transformations of all four are known; so are those of *minima*. The caterpillars are only fitfully attended by ants though these are generally found on the food-plants.

135. Zizera maha, Koilar.—*Wet-season brood.*—Male. *Upperside*: silvery light blue with a satiny sheen in certain lights. Fore wing: the apical half of the costa narrowly and the terminal margin for varying width fuscous black, bounded outwardly on the latter by an obscure, anteciliary, black line. Hind wing: the costa broadly, the termen somewhat more narrowly fuscous black than in the fore wing, with the width of this dark edging similarly variable; in addition there is a very diffuse and ill-defined subterminal series of spots darker than the fuscous margin. *Underside*: brownish-grey. Fore wing: a spot in cell, a transverse lunule on the discocellulars, and a transverse, anteriorly inwardly curved series of eight discal spots (which may be very irregularly placed) black; the transverse lunule and each spot encircled with a narrow, white edging: the posterior two spots of the discal series geminate. Beyond these are a postdiscal and a subterminal series of short, transverse, dusky-black spots followed by an anteciliary black line; the ground-colour between the discal and postdiscal series and between the latter and the subterminal series of spots posteriorly paler than on the rest of the wing. Hind wing: a transverse, subbasal, slightly sinuate line of four spots, a short slender, lunular line on the discocellulars, and a very strongly curved discal series of eight small spots, black; the lunule and each spot encircled with a narrow edging of white; the posterior two spots of the discal series geminate as on the fore wing; beyond these, as on the fore wing, there is a double line of dusky spots, only more lunular with, between them and between the discal and postdiscal series, the ground-colour in the same way outwards slightly paler; an anteciliary, fine, black line. *Cilia* of both fore and hind wings whitey-brown darker anteriorly on the forewing. Antennæ, head, thorax and abdomen dark-brown, shafts of the antennæ ringed with white, club tipped with whitish; in fresh specimens the thorax and abdomen with a little light blue pubescence; beneath: palpi; thorax and abdomen white.—Female. *Upperside*: brownish-black; the basal halves of the wings slightly suffused with light blue, anteciliary black lines on both fore and hind wings, and on the latter wing an obscure, subterminal series of spots as in the male. *Underside*: similar, only the ground-colour darker, the markings larger and more clearly defined. Antennæ, head, thorax and abdomen as in the male, but with no blue pubescence on the thorax and abdomen on the upperside.

Dry-season brood.—Male. *Upperside*: pale bluish-grey with, in some pecimens, a pinkish undertone. Fore wing: as in the wet-season brood, but the black, terminal edging much reduced in width in some specimens to a transverse, somewhat diffuse, very narrow band that borders the anteciliary, black line on the inner side, in others to a much broader similar band that coalesces with the anteciliary black line and occupies about the outer sixth of the wing. This edging along the termen is sometimes even: sometimes it widens from a slender, anteciliary line at and above the tornus to a broad, black patch at the apex of the wing Hind wing: the terminal, black edging much narrower proportionately than in wet-season specimens, most often reduced to a slender, black, anteciliary line with a series of black spots on the inner side, bordering and sometimes coalescing with the line.

Underside : As in the wet-season brood but the ground-colour paler, in some specimens much paler, the markings on both fore and hind wings similar, with frequently the terminal markings obsolescent, sometimes entirely absent or only indicated anteriorly on each wing. *Cilia* whitish. Antennæ, head, thorax and abdomen as in the wet-season specimens.—Female. Similar to the female of the wet-season brood, but more like the male, with the light silvery-blue suffusion very irregular, but generally extended much further outwards from the base. In a female from Poona, the fore wing on the upper side has the basal half silvery blue, the outer half black ; on hind wing, however, the blue colour extends almost to the termen which is only narrowly edged with diffuse dusky black. *Underside*: as in the male ; the ground-colour slightly darker. Antennæ, head, thorax and abdomen similar to those of the male. Expanse : male and female, 28·32 mm.

Egg.—Is turban-shaped, half as high as broad, the sides perpendicular to the top and, perhaps, slightly convex ; the actual base flat and slightly of shorter diameter than the middle of the sides (*i. e.*, than the diameter of the egg half way up) ; the top sometimes very slightly concave ; the whole covered with cells on the top : all cells without any knobs at the inter sections, the walls all slightly raised, not extremely fine, the cells all more or less hexagonal although, sometimes, seemingly irregularly oval, decreasing in size inwards, 24 or more of them on the outside circumference irregularly larger and smaller ; about 14 round the micropyle which is about the diameter of two ordinary cells and about 1/5th or 1/6th of the diameter of the whole egg, being just the very centre of the top, depressed below the walls of the cells but itself covered with minutely thin reticulations all over its surface ; the sides of the egg different : because every intersection of cell-walls is swollen into a pyramid shaped knob with the top rounded coarsely enough and the sides rayed with 6 raised walls which radiate out and down on to the surface to run up again on to the surrounding 6 knobs—these knobs not regularly disposed at all however but, all the same, always 6 in number round whichever is taken as the central one—there are about 3 knobs from the top of the side to the bottom and, as stated above (for the cells of the top) about 24 round the circumference, and seven rows of small cells from the micropyle to it. The surface of the egg is shining, the bottoms of the cells greenish, the rays or walls always pure chalk-white. The H : 0·5mm. by B : 0·25mm.



Zizera maha.

Larva.—It is of ordinary lycænid shape with the front part rounded but somewhat flattened or blunt, the hinder end semi-circularly rounded and very nearly as broadly so as the front ; the dorsal outline more or less convex except on the anal segments 12-14 where it is nearly straight as the anal segments are themselves somewhat flattened ; the transverse section a curve between a quarter and a half circle ; segment 2 with the central depression rather far back, transversely longly triangular, greyish and with a tiny black hair-tubercle or hair at each lateral end on its surface, *i. e.*, near its lateral end, for it is some way removed from the edge ; segment 3 somewhat suddenly higher than segment 2 and inclined to be somewhat flattened on dorsum, its front margin somewhat waved thrice—segment 2 rises up towards segment 3 behind the depression—of course the front part of larva, as represented by segments 3-5, is, in most positions, the highest and fattest part of the larva though, when at rest, normally, the body is slightly fattest about segment 6 as usual with this type of larva. The *head* is shining black with a large, triangular clypeus, the labrum whitish as also the antennal base. *Spiracles* small, nearly quite round, hardly prominent, very light in colour, whitish. *Surface* of larva, dull, covered with many minute, very short, translucent-white, shining, star-shaped hairs from the centre (of the rays or branches) of each of which rises a pointed, short (though much longer than the stem of the stars) hair, this hair generally translucent-white like its base (the star), but sometimes black and of varying length : on segments 2, 3, 4 the black hairs in the subdorsal region are decreasingly numerous: on segment 4 there are about 10 on each side of the dorsal line, on segment 5 about 5, on all succeeding segments only about 3 though the number is not absolutely constant always; the hairs round the margin of the body, that is the region bordering the ventrum and some up towards the spiracles, are a good deal longer, translucent-white (except a few on segments 13-14 which are brown) and segmented-looking and very minutely feathered—making a sort of sparse, short fringe round the whole body which is, perhaps, slightly longest at both extremities; the segments are well-marked enough by depressed lines except on the portion consisting of segments 12-14, where they can only just be distinguished from each other. *Gland* present on segment 11 near the hinder margin, transverse, mouth-shaped; *organs* on segment 12 difficult to distinguish when in repose, as the circular openings are the same colour as the rest of the larva. I have not seen them protruded at any time yet. The ventrum is greenish-greyish. L : 10mm.; B : 3mm.

Pupa.—Is of the type of others of the genus; rather narrow for the length with the distance from front to segment 7 much longer than segment 7-14; the front end squarely blunt across vertex of head—or front margin of segment 2, which is the same thing; the hinder end rounded evenly as the anal segment is turned under as usual; the broadest part is segment 7 and also the highest; the front margin of the pupa is rather broader than the absolute hinder margin, although, because the front half is much longer than the hinder half (segment 7-14), it looks otherwise at first sight. *Head* has the frons very high and perpendicular to the longitudinal axis, the vertex occupying a very small portion just visible in the widely curved though short emargination of segment 2; segment 2 at about an angle of 45° to the same axis (its dorsal line, that is, is at that angle), convex transversely though somewhat flattened dorsally with the dorsal line slightly carinated, very feebly convex longitudinally, its front margin narrowly, widely emarginate as already mentioned, its hinder margin also emarginate, the emargination short and obtusely angled on dorsal line; the thorax considerably humped, evenly convex, its apex about the middle of the segment, the front slope a little less than 60° to longitudinal axis, the hinder slope less to segment 4 whence the dorsal line of abdomen gradually rises again to the highest point at segment 7 : the hinder margin of thorax considerably produced backwards in dorsal line where it forms an angle of about 90° (the two halves, that is, meet in a minutely rounded angle of 90°); this hinder margin meets the wings in a deep, rather largely rounded angle of about 45°—so that the lateral portions of segment 4 are largely exposed, the dorsal line of that segment being very short and only about half the length of that of segment 5 which is itself short; dorsal line of thorax smooth and shining, that of segment 4 ever so slightly carinate. *Spiracles* of segment 2 rather large, oval, slightly raised, rather narrow, opaque whitish; the rest of the same colour, small and round. *Surface* of pupa very slightly shining, transversely hardly perceptibly aciculate, the aciculations plainest on thorax; the segment-margins finely smooth-shining; the surface covered with simple white, erect, fine, pointed hairs about $\frac{1}{8}$ the length of greatest width of pupa, those on the head and segment 2 longer: about 50 hairs to segment 7—they are separated from each other by about their own length so that the covering is not dense; a few of the hairs about sides of hinder segments of abdomen black. *Colour*: light green all over without any markings, the front segments 1—3 slightly darker. L: 8 mm.; B: 3 mm. at segment 7, and 2·5 at middle of thorax.

Habits.—The eggs are laid generally on the undersides of leaves and always singly; rarely one finds them on the uppersides. The little larvæ are very light in colour with, as usual, the segments very well marked and they have long curved hairs. They eat part of the egg-shell after eating their way out through the top, generally to one side of the middle; they never, or hardly ever, eat much of it. They begin feeding on the underside by eating all but the upper cuticle which then withers so that it is always quite easy to find out where they are—much easier than it is to find the egg-larva or even the caterpillar after it is grown up as they are then just the same green as the leaf-uppersides; in the intermediate stages they are various shades of green, gradually getting darker as they change from one stage to the next; and they rest on the flower and leaf-buds which are silky hairy and grey like them so that they are well protected. In the last stage only does the larva eat from the edge of the leaf and it quickly demolishes all the available food yielded by a single plant and has to wander along the creeping roots or rhizomes to find another—often, when the plant is a young one and has no rhizomes, it does not find another and dies of starvation; if it does not get eaten by a spider before that. Many of them are thus eaten in the early stages. The eggs do not seem to be much parasitized as most of those laid produce larvæ. The big larvæ are occasionally attended by ants though by no means always; the genus noticed was *Pheidole*. The growth of the larva is rapid enough but not in any way abnormally so; the pupal stage is normal—about seven days. The pupation takes place anywhere practically: on the underside of a leaf of the plant itself, or of another plant, or on a well-protected surface of a stone, &c.; the attachment is by the tail and a body-band as usual. The imago flies well and erratically, hardly ever straight, in the usual way of the small *Lycænidæ* of this type. They keep close to the ground, are fond of the flowers of vetches and small acanthads (*Justicia, etc.*) which flourish in grass-lands and like the sun; they rest with the wings closed over their backs in dull weather, often with them half-open in the intervals between flights and frequently settle on flower-heads and grasses in the evenings to rest for the night; in the early mornings they may be thus seen with the front wings well sunk between the hinder ones, covered with dew in the cold weather. They are then, generally, quite numbed and may easily be caught in the fingers.

The larvæ feed commonly upon the little Indian Wood Sorrel (*Oxalis corniculata*) which is very similar to the English species with its 3-divided, clover-like leaf and little yellow flowers. Generally grows in well-shaded positions, along ditches, by the sides of water and under trees during the rains. Here the females may be found most abundant, in the afternoons, during the last months of the monsoon, intent upon the business of ovipositing. The males, naturally, also.

A female was once seen to lay two eggs upon the leaves of a vetch, *Tephosia pauciflora*, so that the species is not always abnormal in the choice of the foodplant—the usual foodplants for other members of the genus are vetches, though *Z. lysimon* was found feeding also upon the flowers of *Nelsonia* and *Strobilanthes* which are acanthaceous plants. If you want to find eggs or larvæ of *Z. maha*, however, go to *Oxalis* and not to vetches. It is waste of time looking for them upon anything else; for every one egg on vetches—and there are many many species of vetches—you will find a dozen upon Wood Sorrel. The plant belongs to the *Geraniaceæ* and rarely grows erect higher than a foot—that is a large specimen, though it creeps along the ground for distances of three feet and more rooting at intervals and producing other erect stems or tufts of stems. The seed-capsule bursts elastically often when touched, freeing the little brown seeds—of course it does this, when sufficiently ripe, of itself, in the same way as do the Balsams which are of the same family.

136. Zizera lysimon, Huebner.—Male. *Upperside*: brown with a more or less dense suffusion of violet. In some specimens the violet colour is more clearly apparent in certain lights than in others and extends further outwards, but to lesser degree in wet-season specimens than in those taken in the dry weather or in exceptionally dry tracts of country. Fore wing: terminal margin broadly dark brown. Hind wing: costal and terminal margins broadly dark brown. In a few specimens a subterminal series of round, black spots is more or less clearly apparent on the hind wing. *Underside*: grey. Fore wing: a spot in middle of cell, a short, transverse, lunular line on the discocellulars, and a transverse, anteriorly strongly curved, discal series of eight spots jet-black, the discocellular lunule and the spots each encircled with white; the posterior two spots of the discal series geminate, the three spots above these *en échelon* placed obliquely: beyond these are an inner and an outer, transverse, subterminal series of elongate, dusky spots or short lines and an anteciliary black line. Hind wing: a transverse, curved, subbasal line of four well-separated spots, an abbreviated line on the discocellulars and a transverse, highly curved discal series of eight spots, black, followed by an inner series of dusky lunules, an outer subterminal series of round, dusky spots and an anteciliary, slender, black line. *Cilia* of both fore and hind wings grey, paler outwardly. Antennæ black, shafts ringed with white; head, thorax and abdomen brownish; beneath: palpi, thorax and abdomen sullied white.—Female. *Upperside*: brown with, in a few specimens, the bases of both wings with traces of a violet irroration. In the majority of specimens, however, only the dorsal or posterior half of the hind wing is flushed with violet. Fore wing: the discocellulars with a transverse, dusky, short line. Fore and hind wings otherwise immaculate, with anteceliary, dusky lines. *Underside*: ground-colour darker, in some pale brown; markings on both fore and hind wings as in the male. Antennæ, head, thorax and abdomen similar to those of the male, but on the underside the palpi, thorax and abdomen, in some specimens, purer white. Expanse: male and female, 18-24mm.

Larva.—Shape normal, thickest in middle, sloping towards ends, segment 2 semi-circular in outline, the anal segment about the same breadth as segment 2, rounded at extremity. The head is small, round in shape, the colour black-brown; the neck is long; segment 2 narrowed somewhat in front, slightly longer than broad, the dorsal depression 4-sided, the margin of the segment slightly swollen. The surface of the larva is dull and covered with comparatively long, erect, brown hairs, springing, for the most part, from tiny, white, cylindrical tubercles—these cylinders being brown on the fore part of body—which hairs are interspersed with short, erect, brown bristles; the margins of body are clothed with long, fine, white hairs; segment 2 has the bottom of the dorsal depression studded with tiny, brown, bristle-bearing tubercles. Spiracles are small, light yellow-brown in colour. Colour of body is green, with a dorsal and spiracular, broad line interrupted at the segment-margins and, between these, two indistinct, lateral, whitish lines; all longitudinal. L: 9mm.; B: 3·25mm.

Pupa.—Is of the normal shape, broadest about segment 7, thorax humped, constriction behind it very slight dorsally and still less laterally; the anal end rather pointed for the type, turned under at last segment; segment 2 with the outline of front margin rounded, widely and shallowly emarginate in front, its dorsal slope in the same plane as that of anterior part of thorax; abdomen moderately stout, circular in transverse section. Spiracles of segment 2, slightly raised, white, linearly oval; the rest nearly circular, slightly raised, oval, white. Surface is covered with fairly long, erect light hairs fairly plentifully, these slightly longer at both extremities; the wings naked. Colour: pale opaque green, with a thin, dorsal, black line from end to end and a black line along dorsal margin of wings from middle of thorax to front margin of segment 6. L: 7mm; B: 3mm.

Habits.—The egg, very similar to that of *Z. maha*, is laid in similar places to it: on flowers or leaves, stalks, &c. The larva at first lives in the flowers or flower-buds; afterwards, becoming too large, it is generally found on the pods or stalks, leaves, &c. It is often, but not constantly, attended by small ants. The chrysalis is formed practically anywhere, often on a leaf of the plant or on a leaf of any neighbouring thing. It is attached by the tail and a body-band in the usual way. The periods of growth and rest in the pupal stage are normal. The foodplant of the larva is *Zornia diphylla*, a little semicreeping, grey-hairy vetch characterized by 2-foliolate leaves which are often pressed together and its little red flowers: a very common weed in grassy lands throughout India at all heights up to 4,000 feet and in any rainfall. There may be many other foodplants among the numerous vetches and probably are. The butterfly keeps close to the ground, is fond of the sun and open places, has a weak flight which is never continued for long at a time; it often rests with the wings half-opened in the heat of the day, is fond of flowers and frequents damp places on roads sometimes and may be found resting, numbed in the early mornings of the cold weather, on grasses and bushes, when it can be easily caught in the fingers. When resting thus it has the wings closed and is quite a conspicuous object because of the light-grey underside then exposed, especially when it is covered, as often happens, with dew.

137. Zizera gaika, Trimen.—Male. *Upperside*: dull violet-blue, which changes to a brighter tint of violet in certain lights. Fore wing: the costa very narrowly, the termen much more broadly dull brown; this edging to the termen in most specimens decreases in width from apex to tornus, and is outwardly followed by an anteciliary darker brown line. *Cilia* brownish anteriorly, posteriorly brownish at the base with the apical portions white. Hind wing: the ground-colour brighter than on the fore wing, the costal and terminal margins much more narrowly edged with brown, which edging is merged in the anticiliary dark brown line. *Cilia* brown along their basal halves, white apically. *Underside*: grey. Fore wing: a dusky brown lunular line on the discocellulars; two subcostal spots above the cell, one on either side of the discocellular lunule; two more, subcostal, further along diagonally one above the other; a very strongly curved discal series of five spots, of which the posterior three are somewhat lunular in shape and placed obliquely *en échelon*, the next above these round, the anterior spot hook-shaped: both the subcostal spots and the spots of the discal series are blackish, each narrowly encircled with white; beyond these are inner and outer subterminal dusky lines; which anteriorly are continuous, posteriorly somewhat broken and macular, followed by a very conspicuous, jet-black, anteciliary, slender line. *Cilia* greyish white, traversed by a medial, transverse, blackish-brown line. Hind wing: with the following small white encircled black spots: one basal—a sub-basal transverse series of three, followed by a highly curved series of eight spots that curve across the disc of the wing to the costa and along the latter towards the base; discocellulars with a dusky short lunular line as on the fore wing; terminal markings and *cilia* similar, but the outer and broader, subterminal line more broken and macular than on the fore wing. Antennæ black, the shafts ringed with white; head, thorax and abdomen dark brown, with a little violet pubescence on the head and thorax; beneath: palpi, thorax and abdomen greyish white.—Female. *Upperside*: glossy brown without any violet tint whatever; the anteciliary darker brown lines on both fore and hind wings well marked. *Underside*: very similar to that of the male, the ground-colour a shade darker, the markings slightly larger and more prominent. Antennæ, head, thorax and abdomen as in the male, but the latter three without a trace of violet or blue on the upperside. Expanse: male and female, 20-23 mm.

Egg.—Turban-shaped, the top depressed in centre; the *surface* covered with fine, smooth, raised, irregular reticulations forming irregular-sized pentagons and hexagons; the ridges or lines more or less semi-circular in transverse section. *Colour* blue-green. B: 0·3mm.

Larva.—Normal in *shape*, somewhat long-slender, the second segment semi-circular in shape, narrower than segment 3; the anal segment suddenly somewhat narrower than the preceding 13th, square at extremity; the gland on segment 11 and organs on segment 12 present; the former mouth-shaped, transverse, with two small tubercles behind it; the latter circular, protruding at will, each, a rather long, cylindrical, translucent-looking white cylinder. *Surface* of body somewhat oily looking; some rather long, stiff, black hairs round margin of segment 2 and segment 14, directed straight out; there is, to each segment 3-12, a depressed dorsolateral, longitudinal line making the surface prominent dorsally and laterally and the tops of these prominent parts are set with similar, black bristles or hairs giving the appearance of bunches. *Spiracles* in slight depressions, rather large, circular, white in colour. *Colour*: green with a broad, dorsal, somewhat interrupted band flanked by a whitish band and a dorsolateral white line; a lateral and subspiracular, interrupted red line; the former composed of a red spot on each segment from which the bunch of hairs arises, the latter sometimes obsolescent; the front margin of segment 2 also red. The red markings may sometimes be all very faint. L: 7mm; B: 2mm.

Pupa.—Normal but slender, thickest in middle, anal end very narrow, rounded at extremity, thorax slightly humped, the middle of body highest. Segment 2 rather broad and somewhat square in front. *Surface* covered with longish, white, erect hairs, especially at both ends. *Spiracles* very small, circular. *Colour* green with a red, dorsal line and a black spot at front margin of segment 4, subdorsal. L: 6mm; B: 2·25mm.

Habits.—The eggs are laid singly and, generally, upon the hairs of the bracts of the foodplant, *Nelsonia campestris*. This is a common herb in the damper jungles of Kanara where the larva was first found, with sticky, soft, hairy parts. The larva generally is found eating the flowers with the body half-buried inside. The phases of the egg, larva and pupa are of normal duration in the tropical countries. The larva is attended by small ants which seem to be always about the foodplant though not always on the larva or near it. The butterfly is a weak flier, and always stays near the ground, resting often like the other species of the genus. It seems to be more fond of shade than the others and is plentiful in the big jungles of Kanara, often frequenting damp places where, as a matter of fact, the above foodplant generally grows. It is probable that the larva feeds upon several species of *Strobilanthes*, besides another acanthaceous genus (*Nelsonia* is acanthaceous), most of the members of which, or the species of which are inhabitants of the regions of heavy rainfall.

138. Zizera otis, Fabr.—Male. *Upperside*: pale violet-blue, with a silvery sheen in certain lights. Fore wing: a broad brown edging along the termen, which covers in some specimens quite the outer fourth of the wing, while in others it is much narrower. In all specimens it is broadest at apex and is bounded by an anteciliary darker line, beyond which the *cilia* are brownish at base and white outwardly. Hind wing: anterior or costal third to half and apex brown; a slender black anteciliary line, beyond which the *cilia* are as in the fore wing. *Underside*: brownish grey. Fore wing: a short, transverse, dusky lunule on the discocellulars and a transverse, anteriorly curved, discal series of seven (or eight) minute black spots, all the spots more or less rounded, the posterior two geminate, the discocellular lunule and each discal spot conspicuously encircled with white; the terminal markings beyond the above consist of an inner and an outer transverse subterminal series of dusky spots, each spot edge on the inner side very obscurely with dusky white, the inner line of spots lunular, the outer with the spots more or less rounded. *Cilia* dusky. Hind wing: a transverse, slightly curved, subbasal series of four spots and an irregular, transverse discal series of nine small spots black, each spot encircled narrowly with white. Of the discal spots the posterior four are placed in an outwardly oblique, slightly curved line, the middle two spots geminate; the three spots above these are placed in an oblique transverse line further outwards; lastly, the anterior two spots are posed one over the other and shifted well inwards, just beyond the apex of the cell; discocellular lunule and terminal markings as on the fore wing, but the inner, subterminal, lunular line in the latter broader and more prominent. *Cilia* dusky. Antennæ black, shafts ringed with white and tipped dull orange; head thorax and abdomen brown, with a little blue scaling; beneath: white.—Female. *Upperside*: brown, with a more or less distinct suffusion of violet blue at the base of the wings, on the hind wing continued obscurely along the dorsum; both fore and hind wings with slender anteciliary lines, darker than the ground-colour. *Underside*: ground-colour slightly darker than in the male, markings precisely similar. Antennæ, head, thorax and abdomen as in the male, but the thorax and abdomen above without any blue scaling. Expanse: male and female, 22-27 mm.

Larva.—Normal. *Head* round, smooth, shining yellow, the jaws dark brown, the labrum white, generally hidden under segment 2; before the last moult it is entirely dark-shining, red-brown in colour; segment 2, semicircular in anterior outline with a dorsal, triangular depression; anal end flattened dorsally, sloping to end at an angle of about 30° to the longitudinal axis of the larva, semi-circularly rounded at extremity, the gland on segment 11 slit-shaped, transverse, the organs of segment 12, circular-mouthed protruding a white, cylindrical tube at intervals; body highest about segment 5, broadest about segments 5-7; segment 3 suddenly somewhat higher than segment 2. *Surface* dull, covered with minute, white tubercles each surmounted by a minute, sharp spine or hair; there is, besides, a sub-dorsal row of comparatively large, curved, shiny dark brown hairs on segments 3-10, only two on each side on segments 7-10, four on the rest; the margin of the body is fringed with rather dense, long hairs all round, those at both extremities being longest. *Spiracles* minute, shining, round, raised, yellow. *Colour* grass-green with a subspiracular, yellow band from segment 5 to segment 12; an indistinct, dark, dorsal line. L: 9mm; B: 3mm.

Pupa.—Normal in *shape*. Broadest at middle, highest at thorax-apex, constricted in the dorsal line immediately behind thorax; narrowly square in front, narrowly rounded behind; the vertex of the head (or frons) is in a plane perpendicular to the longitudinal axis of the pupa and rather large and high; segment 2 has the front margin straight with a slight triangular, wide, shallow sinus in the dorsal line, the hinder margin curved convexly towarde thorax: its dorsal line sloping up at 45° to the longitudinal axis, the transverse section only slightly convex; thorax humped, the line joining the front and hinder margins at a slope of 30° to that axis: the dorsal line of abdomen convex, the ventral line straight; the wings slightly thickened parallel to each other along their dorsal margins. *Surface* slightly shining, smooth, covered all over with minute, erect, stiff, pointed, simple, light coloured hairs, especially long round margin of segment 2 and about the anal end. *Spiracles* of segment 2 indicated by smooth, oval, yellow, small surfaces between the margins of segments 2 and 3; the rest are minute, convex, shining white. *Colour* of the pupa is light green with a black, dorsal stripe on segment 2, a dorsal, thoracic, dark line, a black smudge along dorsal border of wings at segments 4-5; two supraspiracular dots on each of segments 7-12; a dorsal, dark green line on the abdominal segments, continuous along the whole length of abdomen; wings and shoulders slightly blotched brownish. L: 7mm; B: 3mm.

Another description of the same, made at a later date, is as follows:—

Egg.—It is very flat, turban-shaped, white in colour. Surface covered with very irregular, fine, filiform reticulations connecting coarse crater-like risings on the perpendicular sides; none of these prominences on the flat top where the reticulations are numerous, forming a mass of small, irregular cells which are very minute in centre. B: 0·5mm; H: 0·25mm.

Larva.—Normal in *shape.* *Head* small, round, shining black, the neck rather long; hidden under segment 2 in repose; segment 2 rather narrow, parabolic in shape, well distinguished from the 3rd, the 4-sided dorsal depression not much lower than the rest of surface; the whole body semicircular in transverse section except at the two ends, the segments well marked; anal end flattened in the usual manner, gently sloping from the longitudinal axis of body, somewhat squarely rounded at extremity; the mouth-shaped gland on segment 11 and organs on segment 12 present; the former rather large and, as usual, transverse; the latter circular, occasionally protruding long, greenish cylindrical tubes simultaneously, each tube again protruding a long brush of white hairs which is flourished rapidly round and round, and withdrawn again to sink back, together with the tube, into the body. The *surface* of the larva is covered with minute star-shaped, bristle-bearing, white tubercles: the bristles brown or white, some longer than others; there are also some sparse, brown-ringed, white dots which are in clusters only round the spiracles and round the gland, being elsewhere scattered very sparsely except on segment 2 where there are sometimes also many; the bristles are not very short; the margin of the larva are set with rather long, soft, white hairs. *Spiracles* are flush, small, circular and yellowish in colour. *Colour* of caterpillar is grass-green with a dark-green dorsal line and an indistinct, diagonal, lateral, white line to each segment. L: 9·25mm; B: 3mm.

Pupa.—Is normal in *shape*; rather narrow, broadest about segment 8, the thorax moderately humped, the constriction behind it dorsally moderate, laterally *nil*; segment 2 slightly emarginate on the front margin, showing the vertex of the head slightly, the whole segment squarely semi-circular, the dorsal slope the same as that of the front slope of thorax; the anal end rounded, the last segment turned under. *Surface* smooth, covered sparsely with moderately long, erect, colourless hairs which are longest at the two extremities. *Spiracles* of segment 2 linear, raised, white; the rest slightly broader, also linear, white, raised. *Colour* green with a double, dorsal, blackish line on thorax; a dark-green dorsal line on abdomen; a black, lateral spot on segment 5 and a black spot on point of shoulder both these small. L: 6mm; B: 2·75mm; H: 2·25 at thorax.

In the larva there are, on segment 3, many more long, brown, erect, slightly curved, dorsal hairs than on any other segment; the two sub-dorsal, long (the longest of these is as much as 0·35mm., in length) hairs on segments 7-10 mentioned in the first description are supplemented by several other, shorter ones on each side; so are also the four on the other segments; the hairs at both ends of the larva are slightly more numerous than anywhere else; some of the dorso-ventral hairs (marginal fringe) are strong and brown in colour; the "brown-ringed, white dots" round the gland are, really, tiny, longish, rounded, glassy tubercles and may be quite wanting about the spiracles; the diameter of the shortly-stemmed stars is about 0·05mm. and some of surmounting bristles are about the same length, some longer, some white, some brown; the distance between tubercles is about 0·1mm; the tiny glandular, glassy tubercles about the gland are hardly 0·025mm. in diameter and about the same height. The larva may be plain green in colour without any markings except an indistinct, darkish line.

In the pupa the hinder margin of the thorax is produced back in the dorsal line where the two halves come to practically a point making the length of segment 4 short in that region; this margin meets the wings in a very windly open, largely rounded angle of about 60° leaving the lateral portions of segment 5 very largely exposed; segment 5 is short. The proboscis only reaches half way to ends of wings, the antennæ are very stout and reach the ends; the legs are only visible for half the way towards ends of wings. The colour is sometimes nearly immaculate grass-green.

Habits.—The eggs are laid single and anywhere on the plant: on leaves, stalks or flowers; the little larva eats the pods and flowers and leaf-cuticle; even when full grown it is difficult to find, but is often attended by ants which helps in that, wherever there are two or three of these gathered together on the plant, there will generally be one of the caterpillars. The pupa is formed anywhere convenient, on the upper or underside of a leaf, either withered or otherwise, etc.; and is attached by the tail and a body-string. The larva has been bred upon *Zornia diphylla* (*Leguminoseæ*), the food also of that of *Zizera lysimon*; but it probably feeds upon small vetches as well. The butterfly may be found in any grass lands in India, Burma or Ceylon; it is fairly plentiful and flies close along the surface of the ground among the herbage or over the little spreading, creeping vetches, stopping to feed at their flowers at frequent intervals; when settled it always rubs its wings together after the manner of so many of the "blues." It sits with its wings closed over the back, rarely in any other position, and is very easy to catch with a net. In the same manner as *Z. lysimon*, too, it may be caught with the fingers when sitting on grass-stalks, etc., numbed with the cold and wet with dew in the early mornings of the cold weather. It is fond of sunlight and is never plentiful in the shady, cool jungles of the hills except in the absolutely open and moderately extensive clearings where its foodplants grow. It is a very small insect, the next smallest to *Chilades trochilus*, which is the tiniest of all Indian *Lycænidæ*. There is nothing interesting to tell about its habits in any stage; nothing to distinguish it from any of its near relatives which are rather a monotonous lot. The distribution is: Punjab, Kumaon, Sikkim; Bengal, Orissa, Central, Western and Southern India; Ceylon, Assam, Burma, Tenasserin; extending to the Malayan Subregion as far as Java and into China.

6. Genus—AZANUS.

De Nicèville says: "But few entomological writers have used the genus *Azanus*; I find, therefore, some difficulty in giving its distribution. One species certainly occurs in Somali land and Aden, as well as in India and Ceylon; another seems to be purely Indian; while a third species occurs in Africa, Syria, India and Ceylon; two more are purely African. If, as is probable, the four species of Mr. Trimen's Section E of the genus *Lycæna* (South African Butterflies, Vol. ii, p. 72, 1887) belong to the genus *Azanus*, then the genus will be further extended into South, and South—and North—Tropical Africa. No species appear to occur in Europe." In India three species are enumerated, small insects, not more than an inch in expanse; the males blue on the upperside; one species with a somewhat broad, outer, pale fuscous border, two (*ubaldus, uranus*) having a patch of differently formed scales on the disc of the fore wing; the third (*jesous*) being uniform. The females as usual have the blue coloration of the upperside more or less restricted to the base, or absent altogether. The transformations of two species are given below. These insects have the thorax robust and wooly, the abdomen short, the antennæ with a well developed spatular club. They all fly well and actively and are fond of the sun and sunny places in the plains; they do not occur in the jungles or in regions of heavy rain, but are always to be found in dry districts where the rainfall is under say 50″, even in the most desert tracts and frequent the neighbourhood of trees of the genus *Acacia* upon the flowers of which their larvæ feed (*uranus*, *ubaldus*). They do not fly high but keep on the wing fluttering about the trees for long periods at a time. They often, similarly, flutter over the ground which is usually littered with the withered and fresh, fallen flower-heads. They settle on the ground, on the leaves of the trees, or twigs, etc., and sit in the usual way with their wings closed over the back, although the males may, at times, be seen basking in similar positions with them partially open. *Ubaldus* is one of the very commonest of blues in Sind and the eastern dry districts of Bombay wherever the foodplants occur. The larvæ have been found plentifully on the flower-heads of *Acacia arabica* or Babul, *A. Senegal* from which we get gum-arabic, and *A. Catechu*; and, doubtless, might be found on others. They are sparingly attended by ants both large and small.

139. Azanus jesous, Guerin.—Male. *Upperside*: a paler and much brighter purple than in *Azanus ubaldus*, the dark blue tint at the base of the wings more pronounced. Fore wing: without the clothing of specialized hair-like scales so conspicuous in *ubaldus*. Hind wing: with the dark tornal spots very obscure. Fore and hind wings: with only slender dark anteciliary lines, but no regular brown edging. *Underside*: dull pale grey. Fore wing: costal margin brown, a black white-encircled spot in cell, a dark chestnut-brown streak between vein 12 and subcostal vein; similarly coloured but somewhat paler transverse bars cross the upper discal area of the wing as follows:—one on the discocellulars and three beyond, each bar edged internally and externally with white: below this two elongate brownish white-edged spots placed *en échelon*, and beyond a slender, unbroken, transverse, postdiscal brown line; a transverse subterminal series of black spots, each surrounded with white, and a slender anteciliary dark line. In most specimens there is also a dusky spot below the cell near the base of the wing. Hind wing: an outwardly oblique short streak from base of cell, a spot below it, a transverse subbasal series of four spots and a complete series of subterminal spots in interspaces 1, 2, 4, 5, 6 and 7, jet-black, each spot surrounded with white; the subterminal spot in interspace 3, a terminal small spot in interspace 7, an outwardly-oblique discal line of six elongate spots, the anterior spot shifted inwards out of line, and a transverse line beyond apex of cell, dark-brown, each of these markings margined with white; on the terminal area there is an inner subterminal lunulated dark line on the inner side of the series of black spots and an anteciliary similar slender line. *Cilia* white, basal halves brown; on the fore wing interrupted also with brown at the apices of the veins. Antennæ, head, thorax and abdomen dark brown, shafts of the antennæ white-ringed, thorax with a little bluish pubescence; beneath: palpi, thorax and abdomen white.—Female. *Upperside*: silky brown, bluish at the base of the wings. Fore wing: a large dark brown discocellular transverse spot and a small quadrate white patch beyond. Hind wing: some two or three obscure dark subterminal spots towards the tornus. In some specimens the series complete from apex to tornus, more obscure anteriorly than posteriorly. Fore and hind wings: both with slender dark anteciliarly lines. *Underside*: ground-colour slightly paler, but the markings very similar to those in the male; the transverse brown bars beyond apex of cell on the fore wing longer, almost extended to the dorsal margin. *Cilia*, antennæ, thorax and abdomen much as in the male. Expanse: male and female, 24-26 mm.

Habits.—The transformations are unknown up to date; or, at least, if known, have not been published. The distribution of the insects as given by Colonel Bingham is: Africa, Arabia, and, within our limits, Baluchistan; the Punjab eastwards through Oudh to the Central Provinces; Central, Western and Southern India; Ceylon; Upper Burma; Myingan (*Watson*).

140. Azanus ubaidus, Cramer.—Male. *Upperside*: brownish purple, dark-blue at base of wings. Fore wing: costa very narrowly along its apical half, termen evenly and a little more broadly from apex to tornus, edged with brown; the area on the disc, in the cell and beyond it is covered with hair-like specialized scales and is distinctly darker. Hind wing: similar, the brown edging to the costa much broader, posteriorly in the tornal area there is a dark spot in interspace 1; and another more clearly defined similar spot in interspace 2, both spots merged more or less into the terminal brown edging. *Cilia* of both fore and hind wings white, with their basal halves evenly dark-brown. *Underside*: greyish brown or brownish grey, with a satiny lustre from base broadly along inner margin; the base of both wings black and white powdered. Fore wing: two short white lines, one each side of the discocellulars: and-nesty streak from base, starting black, under costal vein extending to end of cell, a minute black subcostal dot above apex of cell, another similar dot a little beyond it; two parallel, obliquely-placed, transverse, upper discal white lines, followed by an inner and an outer obliquely placed, irregular broken, subterminal line also white, the inner one somewhat lunular, and an anteciliary dark line; the posterior third from base of the wing uniform, somewhat paler than the rest. Hind wing: a short blackish or nesty line from extreme base at vein 1 up and out to vein 8 near base; the following black white-encircled spots conspicuous: 4 subbasal spots in transverse order, a subcostal spot in middle of interspace 7 (not always minute and often forming one spot), two minute geminate spots at the tornal angle, and a larger one in interspace 2; two transverse short white lines on either side of the discocellulars as on the fore wing; a transverse, curved, catenulated, discal band of white markings, followed by a postdiscal and subterminal series of white lunules and an anteciliary dark line edged inwardly with white. Antennæ dark-brown, the shafts ringed with white; apex of club also white; head, thorax and abdomen dark-brown, the thorax in fresh specimens with a little purplish-blue pubescence; beneath: palpi, thorax and abdomen white.—Female. *Upperside*: rich silky brown. Fore and hind wings: suffused with purplish-blue at base, and with anteciliary black lines. Hind wing: with two black spots at tornal area as in the male. *Underside*: as in the male, but the markings more regular, more evenly and neatly defined, and the white transverse lines on the fore wing carried to the dorsal margin and no satiny lustre. *Cilia*, antennæ, head, thorax and abdomen similar to those of the male, the thorax, however, devoid of any bluish pubescence on the upperside. Expanse: male and female, 21-24mm.

Egg.—Circular in shape, about half as high as broad; the top for about two-thirds of the diameter ever so slightly convex, the sides starting in a gentle curve at first; the sides are slightly convex, the greatest diameter of the egg being in the middle; the whole shape is that of a broad-based bowl; there is no sign of the micropyle as distinguishable from the other minute punctures. The sides of the egg are studded with little truncate-conical, pure white tubercles, the top of each tubercle being flat-circular or oval with the single puncture in the centre; three lines of these tubercles in the height of the egg, the curve to base and top being without any; the top row or ring of tubercles—the rows are not straight but irregular—consists of slightly smaller tubercles than the second and there are about 17 in a complete circle. All the tubercles are interconnected by fine, low, raised lines on the surface of the egg, the lines, when very fine being greenish, when coarser, pure white. Colour: light green, the surface finely, minutely punctate. B: 0·4mm; H: about 0·2mm.

Larva.—The shape is normal, like that of any of the *Nacaduba* caterpillars. It is somewhat triangular in transverse section, the ventrum being flat and rather broader than the sides; the apex of the triangle or dorsum of larva is rounded; each segment is more or less "humped" looked at sideways which means that the segment margins are more or less constricted dorsally: the apex of the hump being nearer the hinder margin than the front margin—this applying of course only to segments 3-10; segment 2 is more or less semi-circular in shape, the front margin slightly waved and has a somewhat circular, dorsal, central depression; segments 11-14 form a parabolic-shaped piece sloping gradually backwards, the extreme margin slightly thickened. The head is small, very shining, black-brown in colour, the labrum whitish, the basal joint of antennæ also whitish, the second brown; the surface is quite smooth; the clypeus hardly distinguishable, triangular; the shape is higher than broad, broadly oval; the colour varies somewhat and may be light or dark. Segments 3 and 4 are concavely depressed transversely in the dorsal region; segments 5 and 6 have a small depression only in the same place. The surface of the body is slightly shining and is covered with minute, dark, slightly round-topped tubercles from the apex of each of which arises a strong, short, stout spinous hair; these hairs being sparse except on the "humps" and on the margin of the body; there is single row of straight, short, whitish hairs round the margin of segment 2 and round the anal segments, as well as a few at the base of each leg and pseudo-leg and in that position on the legless segments; there is a dorsolateral, black point on segment 2 in the depression which bears a minute, light hair; there is a lengthened depression laterally on each segment 3-10 and 6 depressed points just inside the margin of the anal segment. The gland and organs are also present; the former transverse, linear. The spiracles are small, round, white, hardly prominent, situated above the dorso-ventral line. The colour is watery greenish with the "hump" of each segment yellow and a small, brown-rose triangle let in on the dorsal line at the base of each hump; a subspiracular, yellow line interrupted at the segment-margins; a yellow line, backed by a brown-rose one joining the yellow, dorsal marking to this subspiracular line near the posterior margin of each segment: the backing brown-rose line sometimes obsolete in its middle; a long, triangular, rose-brown mark, broadest at anal margin, dorsally on segments 12-14. L: 10mm; B: 3mm.

Pupa.—The pupa is of the ordinary shape of *Nacaduba*, *Castalius*, etc. It has the thorax rather long and somewhat compressed, very little dorsal constriction and none laterally at segment 4; it is broadest about the middle owing to the wings being slightly swollen there, and it is highest, near the hinder margin of the thorax; the head is bowed. Segment 2 is fairly broad, slightly convex transversely, with the front margin straight, the hinder margin slightly convex backwards with a slight tumiditylaterally; the frons of head is inclined towards ventral line and the vertex is just visible beyond the margin of segment 2; the dorsal line of thorax is in the same plane as that of segment 2, ascending gently to just beyond the middle when it again descends very gradually to hinder margin which is a strongly convex curve tending to be pointed in the dorsal line; the angle between it and the wing is curved, deep and open. The surface of the pupa is somewhat shining and quite smooth except for a clothing of very fine hairs which are with difficulty visible even with a lens; there is a very slight, dorsal and lateral depression on each abdominal segment; the segment-margins are slightly prominent; the proboscis not visible between the wings beyond the middle of the part where they meet where only the legs and antennæ appear, the clubs of the latter being hidden under the front margin of segment 9; some minute tubercles at the lower, lateral angle of segment 2. Spiracles of segment 2 indicated by narrow, nearly linear, slightly raised light ovals; the rest are very small, nearly round, all slightly raised, on little swellings, light in colour up to segment 6, blackish after that. Colour of the pupa is light reddish-brown with a yellow tinge. L: 7mm.; B: 2·5mm.

Habits.—The eggs are generally laid on the flower-heads, either on a bud or on a full-blown floret, sometimes on the stalk of the head; the larva usually feeds on the stamens of the full-blown flowers among which it is sometimes quite hidden from view. The caterpillars are attended by ants of the genera *Camponotus* and *Prenolepis*, though never very assiduously. The pupation takes place amongst the withered stamens of flowers which fall to the ground, sometimes amongst those of fresh ones—all flowers of *Acacia arabica*, the foodplant upon which the larva has been found, fall quickly. The attachment of the chrysalis is normal but light; by the tail and a body-band. There is a slight abnormality, however, characterizing this stage of this particular insect which consists in the fact that the pupa is generally enclosed in a cocoon formed very lightly of silks woven all round. This cocoon does not hide the contents completely for the form can be seen through it and it is perhaps formed more with object of keeping the withered (or otherwise) florets together than anything else. The first specimens of the butterfly were bred, in company with *Azanus uranus* in Sind, in September of the year 1904; and, thenceforward, many more were reared. It is a truly open-country insect and is found in all the drier parts of India, eschewing the regions of heavy rainfall where, for that matter, its foodplant is either very scarce or altogether absent. It is more than probable that the larvæ will feed upon any *Acacia*, and there are many species to be found even in the Bombay Presidency. In Sind, and the Districts of Khandesh, Poona, Sholapur, Bijapur, Dharwar, the eastern parts of Satara and Belgaum and even the eastern outskirts of Kanara, it is very common wherever *Acaciæ* occur and may be found any day, in their flowering season, flying in numbers around these trees in the hottest hours. They are insects of bright sunshine and open places, and fly well and quickly though they do not ever go very far at a time; they are fond of resting near the ground or even on it, especially where it is covered with the fallen flowers of the foodplant. In the bright sun the wings are often held half-opened in the position of rest when basking ; the normal attitude is, however, with them closed over the back in the usual lycænine manner. The habitat is: N. W. Himalayas; Baluchistan; the Punjab ; Oudh ; Bengal ; Orissa ; Central, Western and Southern India; Ceylon; Upper Burma: Tilin Yaw (Watson).

141. Azanus uranus, Butler.—Male and Female. Closely resembles *A. ubaldus*, Cramer. The male on the upperside has the ground-colour much paler and the terminal edging on both fore and hind wings much narrower, reduced, in fact, to a conspicuous dark-brown anteciliary line, while the two dark spots at the tornal area of the hind wing are more or less obsolescent. In the female on the upperside the ground-colour is sometimes also much paler than in the female of *ubaldus*, but the suffusion of purplish blue at the base of the wings is often spread slightly further outwards than it is in the female of *ubaldus*. *Underside*: Male and female: ground-colour greyish white; character and disposition of the markings much as in *ubaldus*, but sometimes faint and not clearly defined, often many of them scarcely traceable, the transverse subbasal row of black spots on the hind wings then either completely absent or barely visible. The black subcostal spot in interspace 7, though it may be smaller than in *ubaldus*, is always present while the tornal black spots are always large and prominent in both sexes. Expanse: Male and female, 25-28mm.

Larva—Is very like that of *ubaldus*. The "hump" of each segment is, perhaps, more accentuated; the anal segments 12-14 are perhaps shorter, have certainly fewer dorsal depressions round the margin ; the hinder margin is more inclined to be square, the dorsum of these anal segments is not so flat and the second segment is quite semicircular and not waved at the side as in *ubaldus*; also the surface is more shagreened-looking, being covered with minute, more or less appressed, shining, minute, white-transparent, short, broad hairs all over; there is a dorsal depression on segments 2 and 3 and a small, roundish, dorsal depression at front margin of segment 5. The colour is light green with a dorsal, reddish band and signs of a lateral, similar one, both often reduced to a faint mark in the centre of each segment; the hinder face of the "humps" is generally yellowish and there is a glint of yellow on the subspiracular region; at the depressions of segments 3-6 the dorsal, red band surrounds them and does not extend into them; the depression on segment 2 is black and has a minute lateral black tubercle bearing a black hair. The head is very light yellowish-brown with the clypeus outlined dark-brown; otherwise it is as in *ubaldus*. The spiracles are minute and whitish in colour. L: 10mm; B: 3mm.

Pupa.—The only difference between this and that of *ubaldus* is that this is always black spotted all over, above and below while the other is quite plain. In this and the other there are some minute tubercles at the lower. lateral angle of segment 2 and the antennæ in both are visible between the wings; the ends of the clubs being hidden under the margin of segment 9. The surface is clothed as in the other species with very fine, minute, hardly perceptible (even with a lens) hairs. The colour is a shining, very light, dull pink; the blotches are subcutaneous looking. L: 7mm; B: 2·5mm.

Habits.—The caterpillars live like those of *ubaldus*, altogether on flowers of *Acacia arabica* and *A. senegal* and probably others; and are attended by ants of the genus *Camponotus* as well as others: the pupation takes place on a leaf, flower stalk or among the flowers the attachment is very light; and, while the larva of *ubaldus* makes a more or less perfect silken nest or cell amongst the flowers, this one never does, but pupates in the open. Both the habits and the habitat of both species, *ubaldus* and *uranus*, are practically identical as regards the perfect insects; the one is found at all times in company with the other and what is true of one is true of both. The habitat is: Baluchistan; the Punjab; Karachi; Oudh; Kumaon; Bengal: Central and Southern India.

(*To be continued.*)

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INDIAN DRAGONFLIES.

BY

Capt. F. C. Fraser, I.M.S.

(*With* 13 *Plates*.)

Rambur in his account of the world's Neuroptera published in 1842, described some forty odd species as coming from India. Since that date, the number of species and genera described has largely grown and the figure now stands at about 160. The Baron Edm. de Selys Longchamps published a series of monographs on the world's Dragonflies between the years 1854-1886 and Kirby's Synonymic Catalogue of Neuroptera—Odonata was published in 1890. A long series of papers and works appeared subsequently in as nearly as many different journals, transactions and proceedings of zoological and entomological societies. Finally from 1910 there appeared a series of fascicles, published by the sons of the late Baron de Selys, which included the World's Odonata under the title of:—"Collections Zoologiques du Baron Edm. de Selys Longchamps", which work still remains incomplete. A glance at the references, therein given, of any one species will serve to show how enormously scattered is the literature on the subject.

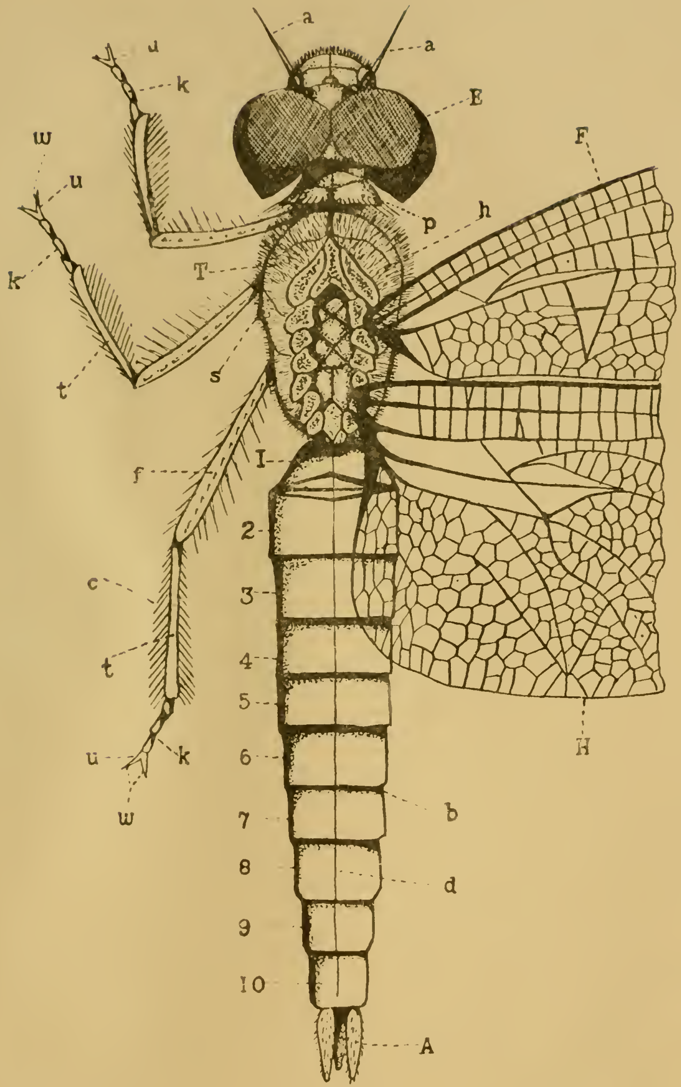
It is mainly due to this inconvenience that the collecting and study of Indian Dragonflies has been so neglected in comparison to the thorough way in which the Lepidoptera and to a less extent, the Coleoptera have been worked at. There are other drawbacks in addition to the foregoing which face the collector, especially if he is collecting in one of the wet areas. Dragonflies are such voracious feeders that there is always a large store of wholly or partly digested food material in their bodies, decomposition of which, unless it be carefully dissected out within an hour or so after death, completely destroys the majority of specimens. The brilliant colours found in many species during life, have a disappointing way of fading soon after death and so, much of the beauty and interest in the insect is lost. Careful cleansing out of the food material will however largely prevent this drawback. Lastly there is an intensely destructive little fly which has an insidious way of getting into the boxes where fresh specimens are drying and depositing their eggs in the thoraces. There is a large amount of muscular tissue in this part of the dragonfly's anatomy which it is impossible to dissect out and on this the larvæ of the fly feeds and one sees with chagrin, the specimen decomposing and falling to pieces under ones eyes.

Faced with obstacles such as the foregoing, it is not surprising that the Indian Odonata have suffered from neglect at the hands of entomologists in this country and until the scattered literature

INDIAN DRAGONFLIES.

Explanation of Plate I.

A.	Anal appendages.
a.	Antennæ.
b.	Intersegmental node.
d.	Mid-dorsal ridge.
E.	Eye.
F.	Fore-wing.
H.	Hind-wing.
f.	Femur.
t.	Tibia.
u.	Ungue or Claw.
c.	Ciliæ (or " tarsal spines").
k.	Tarsus.
T.	Thorax.
p.	Prothorax.
s.	Thoracic spiracle.
h.	Humeral region.
1 to 10.	Abdominal segments.
w.	Claw hooks.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INDIAN DRAGONFLIES.

Dorsal aspect of a Dragonfly (×5).

has been carefully sifted, collected and woven into a whole, this fine kingdom of insects will fail to excite their fair share of interest.

At the present time Mr. F. F. Laidlaw is publishing in the Records of the Indian Museum a list of the Dragonflies recorded from the Indian Empire. (Records of the Indian Museum, Vol. XIII, Part I.)

The following papers are intended to give firstly a brief outline of the anatomy and biology of Indian Dragonflies and subsequently a description of the various families, genera and forms found within Indian limits.

Among the paleontological remains of Neuropterous insects, fully fifty per cent. have been classified as belonging to the Odonata thus proving that they are a remarkably ancient order, *e.g.*, *C. platyptera*, Charpentier, has been found in the Oligocene and *C. scheuhzeri*, Massal, in the Eocene. A large number of Æschnines are found amongst these fossils, some of them well preserved and analogous to existing forms.

This group of insects has a world-wide distribution and although the number described from India is not large when compared to its Lepidopterous fauna, this country will probably be found to be as rich as most of the other parts of the Old World when further interest has been paid to them. Their range extends from the Arctic to the Antarctic circle and unlike most other insects in their geographical distribution, the confines, of most of the species are not nearly so circumscribed by natural features such as mountain ranges, seas and sandy wastes. This is more true as applied to the Anisoptera than to the Zygoptera on account of the relatively greater powers of flight of the former, but even the latter have a wonderful way of spreading along the course of the great rivers for many hundreds of miles. Part of this latter distribution must be put down to water-bourne ovæ, as many species have a habit of depositing their eggs in or on the surface of swiftly running streams. Certain species have a habit of migrating in vast swarms, many such having been recorded from time to time and I have myself seen two, one in Mesopotamia, when as many as twenty specimens could be taken with one sweep of the net and the other some forty miles out at sea, off the Kathiawar coast. Occasionally and exceptionally, one finds some species restricted to extraordinarily narrow limits. As would be expected from the foregoing, not a few of the Indian species are found to be common to other countries, specially Europe and parts of Asia.

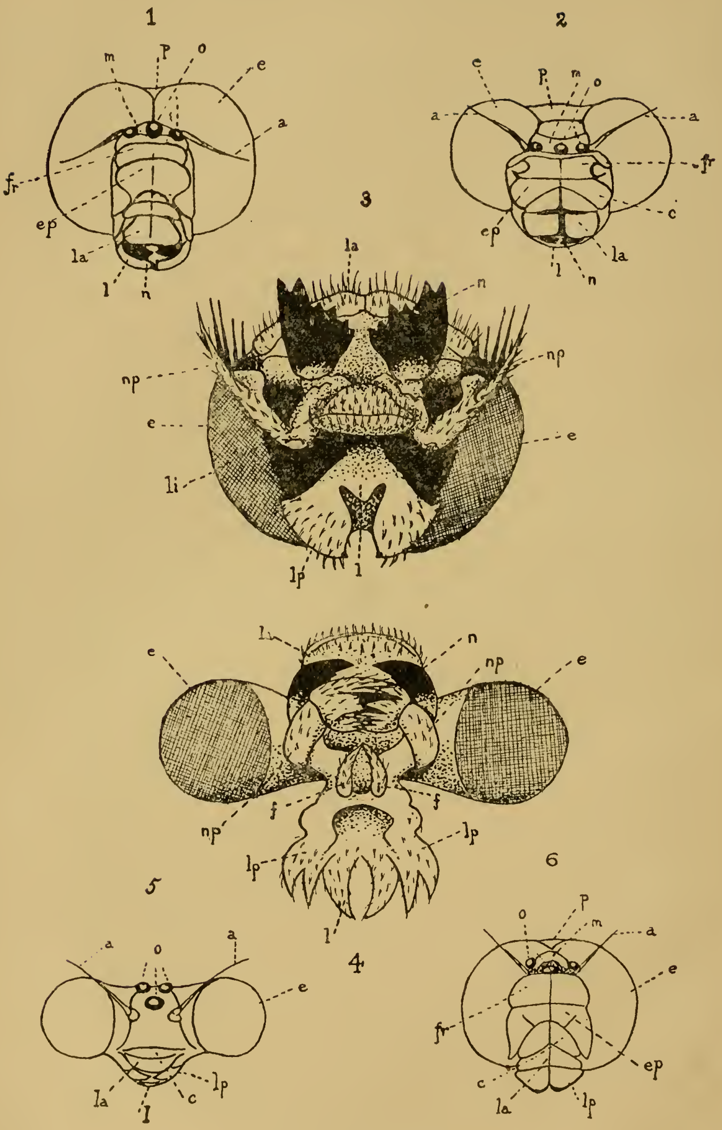
Marked differences of opinion have been shown as to the true position of the Odonata in the Insect kingdom, most authorities being content to follow the old Linnean system and to place them as a sub-order of the Neuroptera. There seems to be a tendency to place many odd divisions of insects into the latter order which have not fitted into other existing and more homogeneous orders. The main argument for including them in the Neuroptera is on account of the neuration of their wings, but if we enquire closely into the comparative anatomy of Dragonflies we find that they possess as close an affinity to the Orthoptera as to the former order, agreeing with them especially in regard to the structure of their mouth-parts and to their incomplete metamorphoses. They appear to lie midway between these two orders and for this reason and by virtue of the distinctive facies possessed by these insects which makes them as compact a group as are the Lepidoptera or Coleoptera, one is justified in raising them to a similar rank.

Order—ODONATA.

The Odonata are predatory, carnivorous, mandibulate insects, whose life-cycle is split up into a larval stage spent in an aquatic environment and an imaginal stage spent in the air. The head is comparatively large, the greater part being formed by the eyes : the prothorax is small and inconspicuous : the meso-and meta-thorax are bulky and fused into one : the abdomen is composed of 10 complete segments : the wings, four in number, are membranous, the membrane supported on a framework of stout nervures and a closer network of finer, secondary nervures : the legs, of which there are three pairs, are usually spined or ciliated : the sexual organs of the male are situated on the 2nd and 9th abdominal segments ; of the female, on the ventral surface of the 9th abdominal segment : respiration is carried out by means of a large thoracic spiracle and a sub-ventral, pleural membrane. The larvæ are characterised by the possession of a labium furnished with pincers or jaws and capable, by means of two joints, of propulsion forwards, by which means the larva seizes its prey ; they are either direct rectal breathers by means of rectal gills or indirectly so by means of lamellated processes attached to the anal end of the abdomen.

The metamorphosis is incomplete, in that there is no distinct resting stage between the larva and the imago corresponding to the pupation of Lepidoptera. Their morphology, taken in detail, is remarkably diverse but their facies as a whole, is so characteristic that there is never any difficulty in determining whether any particular insect is or is not a Dragonfly. In their life-cycle they pass through a number of stages, beginning with the egg and passing through an, as yet unknown, number of larval stages, the larva sloughing its skin between each instar. Finally the skin is shed for the last time, the larva leaving its aquatic home for this purpose and climbing up some handy reed or trunk of a tree. The newly emerged imago is an almost colourless, soft but remarkably plastic creature. The wings rapidly expand and the stumpy abdomen lengthens but the full colouring of the insect is not attained for about four days or more, so that according to the age of the specimen, a very different appearance is presented. For this reason, newly emerged specimens are sometimes spoken of as " juvenile " and those which have attained their full colouring as " adult " specimens. The former may always be recognised by the extreme glossiness, amounting almost to an oily appearance of their wings.

The final instar of the larva does not appear to vary much from the previous ones and although it is sometimes spoken of as a " nymph, " it can hardly be said to be the analogue of a pupa.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INDIAN DRAGONFLIES

Head and Mouth Parts.

INDIAN DRAGONFLIES.

Explanation of Plate II.

1.	Head of an Aeschnine (× 4).
2.	Head of a Gomphine (× 6).
3.	Mouth parts of an Aeschnine, seen from below (× 6.)
4.	Mouth parts of an Agrionine, seen from below (× 17.)
5.	Head of an Agrionine (× 9·5).
6.	Head of a Libelluline (× 4·5).
m.	Vesicle.
p.	Occiput.
o.	Ocelli.
e.	Eye.
a.	Antennæ.
ep.	Epistome.
c.	Clypeus.
la.	Labrum.
l.	Labium.
n.	Maxillæ.
np.	Maxillary palps.
li.	Lingua.
f.	Fauces.
lp.	Labial palps.
fr.	Front.

The Imago (Plate I.)

The imago is made up of a head, a prothorax furnished with a pair of legs, a thorax furnished with two pairs of wings and legs, and lastly a more or less elongated abdomen, the terminal segment of which is furnished with one or two pairs of curious anal appendages.

The Head of which the eyes form the greater part, is ordinarily and relatively very large and is either globular or more or less, transversely elongated. Posteriorly it is deeply cupped, the concavity being known as the "occipital cavity" and here it articulates by means of two condyles, with the prothorax, which latter structure projects so far into the occipital cavity as often to be almost or completely hidden. The condyles allow a very free movement of the head in almost any direction. The eyes are two, large, compound organs made up of many hexagonal facets, numbering in the larger species upwards to 20,000 in each eye. The facets are larger on the upper surface than they are on the lower, an arrangement which affords the insect the advantages of long and short sight, the latter being very necessary in order that it may scan the surface over which it is flying. Another factor which very materially assists the keen sight of these insects is that the eyes are more deeply pigmented above than below. The eyes according to the species are contiguous across the middle line to a greater or lesser extent or they may be slightly or widely separated. In Plate II, fig. 1, the eyes of an Aeschnine are shown broadly contiguous, in fig. 6 the eyes of a Libelluline are shown just touching: again in fig. 2, those of a Gomphine are seen separated and lastly in fig. 5 the eyes of an Agrionine are seen so widely separated as to appear as if stalked or pediculated. This pediculation of the eyes is even more noticeable when viewing the head from beneath as seen in fig. 4.

According to the development of the eyes and their relation to one another, depends the size of the "occiput" or that part of the head lying between and behind the eyes. In the Aeschnines and Libellulines it is triangular and small: in the Gomphines and Agrionines it is quadrilateral and relatively larger. Posteriorly it forms part of the rim of the occipital cavity, the remaining portion of this lip being formed by the free margin of the eyes and usually rounded, tumid or sinuous.

Between and in front of the eyes in the Anisopteridæ and in some of the Zygopteridæ (*Rhinocypha and Micromerus*) will be seen a more or less prominent eminence or tubercle which is known as the "vesicle." In the Libellulines this structure is somewhat triangular and cupped in front and encloses the middle ocellus, one of three accessory eyes known as "ocelli." In some of the night-flying Odonata the vesicle overhangs the middle ocellus to such an extent as to suggest the hood of a motor-lamp and may materially assist the function of sight. The ocelli are small, oval or rounded, polished bodies placed about the vesicle in a triangle in some genera or in a transverse straight line in others. In juxta-position to the outer ocelli, are situated the antennæ, slim, short and comparatively inconspicuous and formed of two moderately robust basal segments and four longer and finer terminal segments, the distal one being pointed. (Never clubbed as in the Ascalaphinæ which are sometimes mistaken for Dragonflies.) The antennæ are often scantily furnished with stiff, minute hairs.

The fore part of the head consists of a broad, angulated plate, the "clypeus", which is divided by a suture crossing its upper part into the "front" or part above the suture, and the "epistome" (Plate II, figs. 1, 2 and 6) or the part below it, from which is suspended the upper lip or "labrum". The front presents a sharply angulated or rounded border in its upper part, which is usually more or less, deeply notched. (Anisopteridæ.) The epistome is usually flat but in two genera of the Zygopteridæ, it shows a remarkable development and in them has the appearance of an exaggerated, retrousse nose. The lower border is rounded and the sides are usually prominent and overhanging. The labrum (Plate II, 1a.) is narrower than the epistome, its sides and lower border being rounded and often notched and its middle grooved by a deep sulcus. The lower lip or "labium", (Plate II, 1 and 1p.) which differs in the different genera, is composed of three parts, a median, often very minute and triangular or elongate and bifid organ, which is the true labrum, and two lateral which are the labial palps and are composed of two or more segments. The basal segment is small and inconspicuous, the median large and foliate or very narrow according to the species. It, together with the labrum, almost or entirely covers the jaws. The last segment is small and often completely absent in the Libellulinæ. The labium is attached to the under part of the head near the occipital articulation, by a narrow piece known as the "menton."

The maxillæ are short and very massive, somewhat molar-shaped, the blunt tooth-like points which they bear, being arranged zig-zag-wise. The maxillary palps are long and formidably armed with long teeth, usually five or six in number and furnished also with long, stout bristles which are used to grapple the prey with. In the middle of the mouth and behind the jaws, is seen a membranous organ, the "lingua", which is covered with imbricated spines. (Libellulines.) Its place in the Agrionines, is taken by the pillars of the fauces or sides of the throat, which also bear similar, imbricated spines. These latter which line practically the whole of the inner lining of the buccal cavity, assist the function of passing the food onward into the æsophagus.

The Thorax.

The thorax is formed of an anterior part known as the "prothorax," (Plate I) and two posterior segments, the meso-and meta-thorax which are fused into one mass, the line of junction being only defined by shallow sutures on the sides. The prothorax presents three lobes, an anterior, the "pronotum," which articulates with the head, a middle and a posterior lobe which last is useful for classification on account of its great variability. This posterior lobe has in the different species, a simple or notched border and it may be bi-or tri-lobed, triangular, obtuse or acute and often bears on its free border, a ruff of long, stiff hairs which interlace with a ring of shorter, stiff ciliæ lining the margin of the occipital cavity.

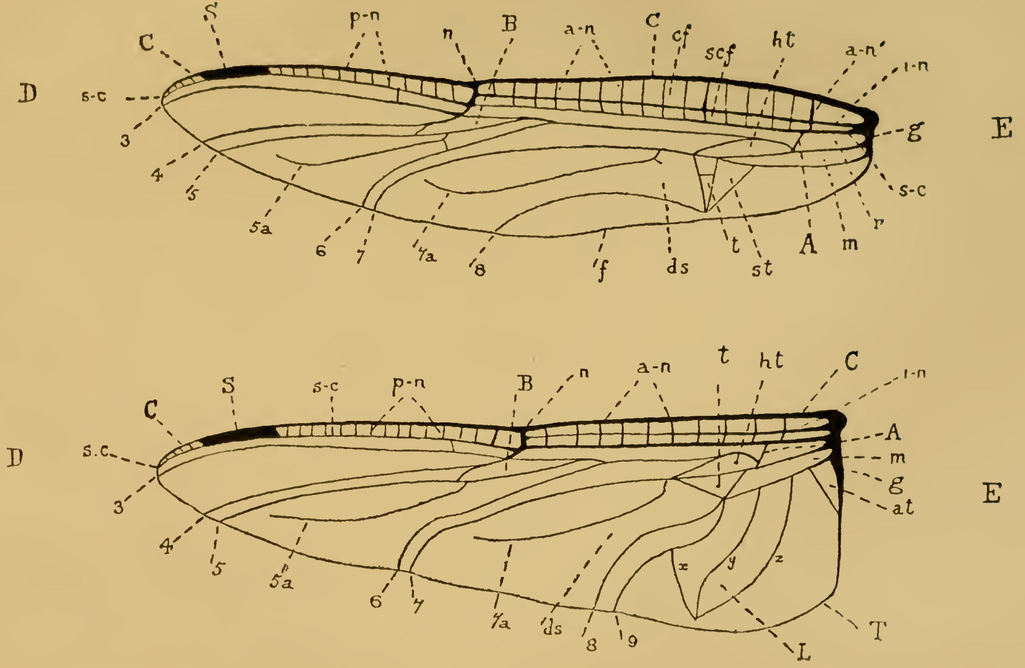
The thorax proper, is usually robust, quadrilateral but sloping above and in front and beneath and behind, so that viewed from the side it appears somewhat lozenge-shaped. The anterior part of the dorsum slopes rapidly towards the prothorax, its borders, which form the "humeral region," often being the site of broad, coloured fasciæ. Laterally are seen two sutures, one slightly anterior to the middle line and the other between the meso-and meta-thorax. Between these two sutures, situated rather low down, is seen a small papillæ, on the summit of which opens the "thoracic spiracle." This is the respiratory pore through which the insect takes in and expires air. On the upper and posterior part of the thorax are attached two pairs of wings, springing from chitinous outgrowths and separated by a space, the "tergum," which contains other, minute processes which serve for the attachment of the muscles working the wings.

(Note.—The systems of nomenclature of the wing-parts, adopted by French, British, American and German writers are all different, the French and especially the German being abnormally clumsy. That given here, is a compromise and a simplification of the whole, *e.g.*, instead of

INDIAN DRAGONFLIES.

Explanation of Plate III.

A.	The Arc.
D.	Apex of wing.
E.	Base of wing.
f.	Termen.
n.	Node.
g.	Membrane or Accessory membranule.
C.	Costa or costal nervure.
S.	Stigma or pterostigma.
T.	Tornus.
m.	Cubitus or cubital space.
ht.	Hypertrigone.
t.	Trigone.
r.	Subcostal space. (Median space. Needham).
B.	Nodal triangle or Bridge.
ds.	Discoidal field.
st.	Subtriangle.
at.	Anal triangle.
L.	Loop.
x.	Anterior border of loop.
y.	Mid-rib of loop.
z.	Posterior border of loop.
a-n.	Antenodal nervures.
p-n.	Postnodal nervures.
s-c.	Subcostal nervure. (Median nervure. Needham).
3, 4, 5, 6, 7, 8, 9.	Principal nervures.
5a and 7a.	Supplementary nervures.
cn.	Cubital nervure.
a-n'.	First antenodal nervure.
i-n.	Intercostal nervure.
cf.	Superior costal field.
scf.	Inferior costal field.
s.a.	Sectors of arc.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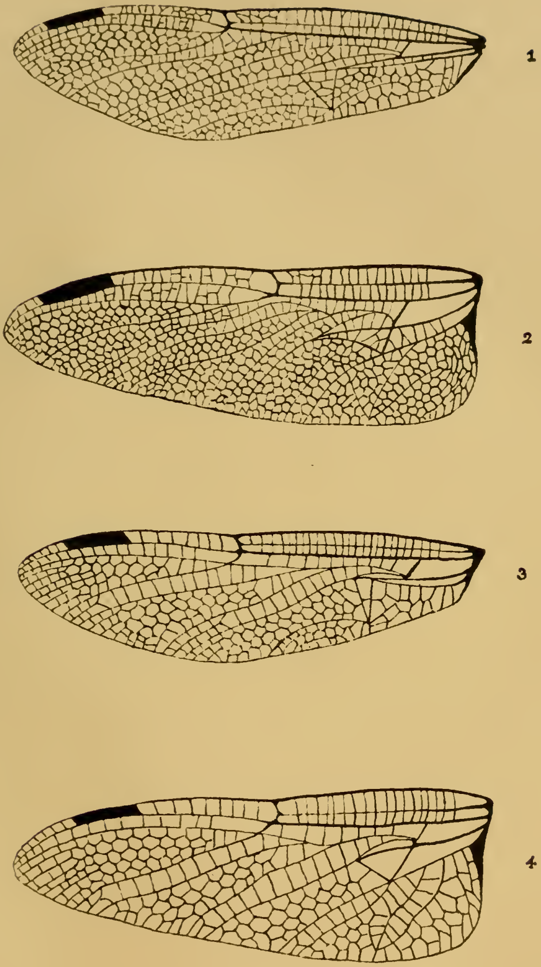
INDIAN DRAGONFLIES.

Main neuration of Fore and Hind wings.

INDIAN DRAGONFLIES.

Explanation of Plate IV.

1. Fore-wing of a Libelluline, atypical species (× 2·4).
2. Hind-wing of same (× 2·4).
3. Fore-wing of a Libelluline, typical species (× 2·4).
4. Hind-wing of same (× 2·4).



Indian Dragonflies.

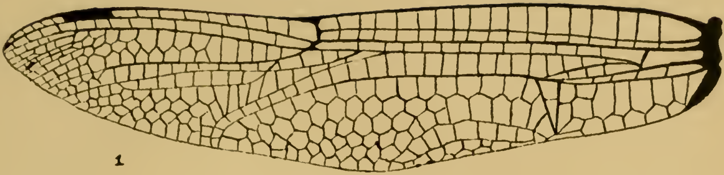
Atypical and typical wings of Libellulines.

INDIAN DRAGONFLIES.

EXPLANATION OF PLATE V.

1 and 2.	Fore- and Hind-wings of a Corduline (× 2·5).
3 and 4.	Fore- and Hind-wings of an Aeschnine, genus Anax (× 2·5).

Plate V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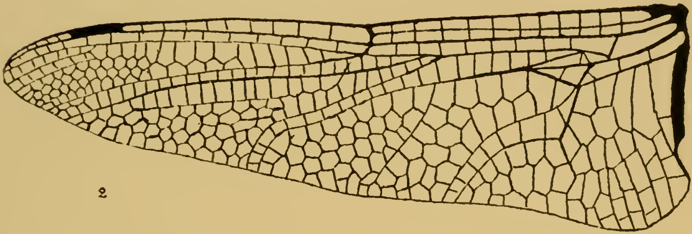
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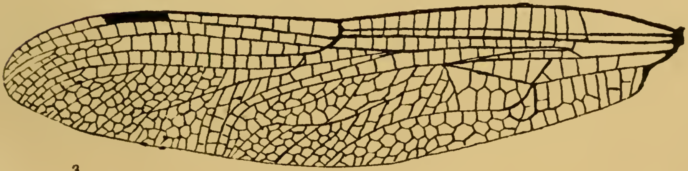
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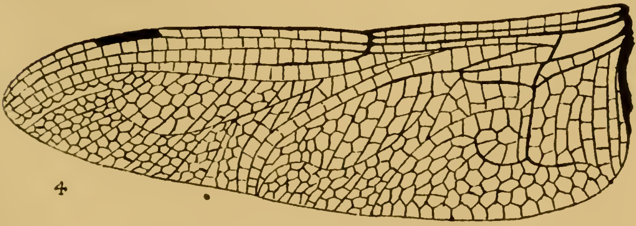
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INDIAN DRAGONFLIES.

Fore and Hind wings of Cordulines and Aeschnines.

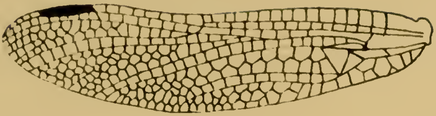
INDIAN DRAGONFLIES.

Explanation of Plate VI.

1 and 2. Fore- and Hind-wings of a Gomphine (× 2·2).

3. Hind-wing of a Calopterygine (*Calopteryx chinensis*) (× 2·0).

4. Hind-wing of an Euphœa (*E. dispar*) (× 2·0).



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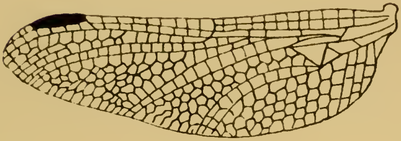

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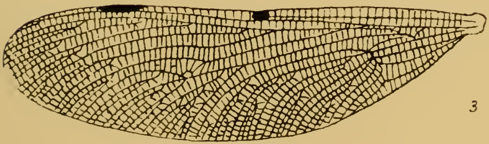

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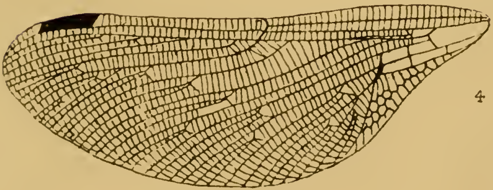

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INDIAN DRAGONFLIES.

1 and 2—Wings of a Gomphid. 3 and 4—Hind-wings of a Calopterix and Euphœa.

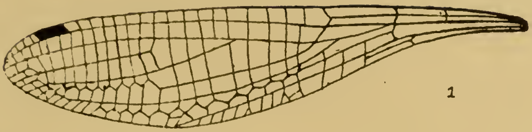
INDIAN DRAGONFLIES.

EXPLANATION OF PLATE VII.

1 and 2. ♀ and ♂. Hind-wings of atypical Agrionine (*Argia quadrimaculata*) (× 4·0).

3. Fore-wing of a typical Agrionine. Genus, Agrion (× 4·4).

4. Fore-wing of female Micromerus (*Micromerus lineatus*) (× 4·0).



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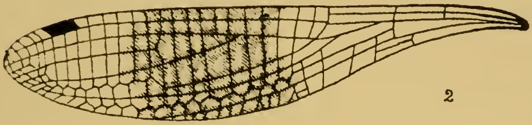

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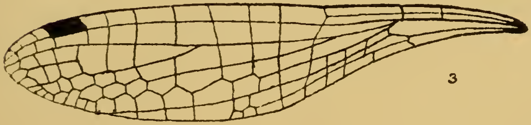

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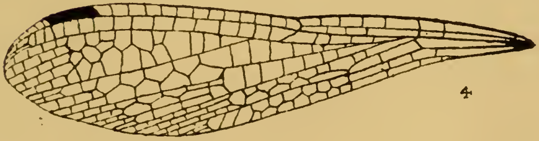

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INDIAN DRAGONFLIES.

Wings of Agrionines and of a Micromerus.

retaining the long specific names for each of the eleven main nervures, the expedient of numbering them in order from apex to base, has been adopted as one more easy to work with when describing the species.)

The Wings.

The wings are long, narrow, membranous organs, built on a system of main sectors or nervures and a secondary reticulation or network of minor nervures. The wings of the Anisopteridæ (Plates 3, 4 and 5), are unequal, the hind being broader than the fore and dilated at the base, that is, the part nearest the attachment of the wings. In the Zygopteridæ, (Plates 6 and 7) the fore and hind wings are usually equal and never dilated at the base, although there may be a broadening at their middle. (Plate 6, fig. 4. *Euphæa.*)

The anterior border of the wing is known as the "costa," and presents somewhere near its middle, the site varying in the two wings and markedly in the various species, a stout, transverse nervure, the "node," at which point, the costa is generally slightly angulated. Posterior to and running parallel to the costa, from apex to base, is a second nervure, the "subcostal." (The "median" of French authors and "R-M" of the German.) Between the costa and subcostal nervures, running from the base to the node, is an intermediate nervure, the "intercostal." (The "subcostal" of French and German writers.) The space above this is called the "superior costal field" and the space below it, the "inferior costal field." A series of transverse nervures running between the costa and subcostal nervures, on either side of the node, are called the "ante—and post-nodal nervures," respectively. Traversing the wing, posterior to the subcostal nervure, are a series of main nervures, the "3rd, 4th, 5th, 6th, 7th, 8th, and 9th" and in addition to these will be found, in many species, lying immediately posterior to the 5th and 7th, two supplementary nervures, the "5a" and "7a." Near the base, the 3rd nervure meets a small, curved nervure springing from the anterior border of the 7th and fusing with it over a varying distance, to form the "sectors of the arc", the "arc" being a small, transverse nervure running back from the basal end of the subcostal. The space between the sectors of the arc and the 7th nervure is the "hypertrigone." The outer extremity of the wing, is its "apex," and the posterior border, its "termen." In the hind wings of the Anisopteridæ, the termen meets the basal border at a sharp or rounded angle, the "tornus." A tornus is not a marked feature in the fore wing and is never present in the Zygopteridæ. In the Anisopteridæ, posterior to the hypertrigone, will be seen a triangle, the "trigone", with its apex directed towards the termen. According to the species, the trigone may be equilateral, acute or obtuse and may or may not be traversed by one or more nervures or again, may be filled with a network of fine nervures. Its outer angle corresponds to the point at which the sectors of the arc cuts the 7th nervure. In the fore wing there is often a third triangular area lying immediately internal to the trigone, in the angle formed between it and the 7th nervure and this when present is called the "subtriangle." The space posterior to the basal part of the 7th, limited outwardly by the trigone and inwardly by the base of the wing, is called the "cubitus": the space above the same part of the 7th, limited outwardly by the arc and inwardly by the base, is the "subcostal space." The space between the 7th and 8th nervures, limited inwardly by the outer border of the trigone, is the "discoidal field" and may hold one, two or more rows of cells, thus forming a useful point for classification purposes. The base of the wings in the Anisopterdæ, is strengthened by a rudimentary, opaque membrane, more or less extensive, which is known as the "accessory membrane" and which is more evident in the hind than in the fore wings. The angle formed between this and the posterior border of the cubitus, is known as the "anal triangle" and is usually only present in the hind wing. In the hind wing, in the majority of the Anisopteridæ, (as shown in the diagram given on Plate III.) three nervures "x, y and z", will be seen springing from the 9th nervure and the posterior border of the cubitus, directed backwards towards the termen and all meeting in a point just before the terminal margin of the wing. The "loop", as it is called, thus formed, is important both for classification and descriptive purposes. The reticulation of the wings formed by a network of small cells or "areolets" is more or less close or open in the different species. Usually the wings are clear or hyaline but in many species they are marked or beautifully coloured, often with brilliant, metallic hues.

In not a few species, this colouration is found to be limited to the hind wings, a circumstance which may be explained by a study of the method of flight adopted by these insects. During flight the fore wings only are used for propulsion, the hind functionating as a pair of supporting planes, thus whilst the fore—are in rapid vibration and almost invisible, the hind wings are held practically motionless, exhibiting their vivid colours to the full advantage. This method of flight explains also the differences in shape between the fore and hind wings of the Anisopteridæ. The fore are narrow so as to offer the least resistance to the up-strokes, the hind are broadened to afford a large supporting surface. The flight of some of the Calopterygines as they skim over the surface of the water, the fore wings practically invisible, the hind spread out, almost motionless, scintillating with brilliant metallic hues, is one of the most beautiful sights that Nature affords.

In order to simplify and render more workable the identification of species, the nomenclature of the wing parts has been considerably modified, it is therefore necessary to give the following table which compares the adopted with the Selysian and Needham notations :—

Simplified nomenclature.	Selys.	Needham.
Costa.	Costal nervure.	C.
Subcostal nervure.	Median nervure.	R.+M.
Intercostal nervure.	Subcostal nervure.	Sc.
Antenodal nervures.	Antecubital nervures.	Anq.
Postnodal nervures.	Postcubital nervures.	——
Node.	Nodus.	N.
Subnode.	Subnodus.	sn.
Bridge or Subnodal triangle.	Proximal part of subnodal sector.	B. (br.)
Bridge nervures.	————————	Bqs.
Sectors of arc.	Upper sector of arc.	M1—3
	Lower sector of arc.	M4
Subcostal space.	Median space.	sc.
Superior costal space.	Costal space.	c.
Inferior costal space.	Subcostal space.	sc.
Trigone.	Discoidal triangle.	t.
Hypertrigone.	Hypertrigonal space.	ht.
Subtrigone.	Internal triangle.	ti.
Termen.	Postcostal border.	——
Tornus.	Anal angle.	——
Anal triangle.	Anal triangle.	——
Loop.	Anal loop.	al
Mid-rib of loop.	————————	A2
Outer border of loop.	————————	A1
Inner border of loop.	————————	A3

Simplified nomenclature.	Selys.	Needham.
Discoidal field.	Discoidal field.	—
Cubital space.	Submedian space.	Cu.
Cubital nervures	Submedian nervures.	Cuq.
3rd nervure.	Principal sector.	M1
4th nervure.	Nodal sector.	M2
5th nervure.	Subnodal sector.	Rs.
5a (supplementary nervure).	—	Rspl.
6th nervure.	Median sector.	M3
7th nervure.	Lower sector of arculus.	M4
7a (supplementary nervure).	—	Mspl.
8th nervure.	Superior sector of triangle.	Cui
9th nervure.	Inferior sector of triangle.	Cu2
Arc.	Arculus.	Arc.
Anal field.	—	—
Stigma.	Pterostigma.	st.
Membrane.	Membranule.	mb.

The Legs. (Plate I.)

The legs consist of the usual five parts found in insects, that is, the coxa, trochanter, femur, tibia and the tarsus, the latter having three segments and ending in a pair of hooked claws or ungues which are furnished on their inner sides with minute hooks, these latter differing in size with the species. The femoræ and tibiæ are usually furnished with one or two rows of stout or fine and long or short spines and one or two rows of ciliæ, varying in size and usually gradually increasing in length from the proximal to the distal ends. The legs are only used for resting, never for walking but they perform an additional and an important function by assisting to seize the insects prey. This they do whilst flying, all the legs being sloped forward, the ends held at an equal distance apart so as to form a sort of ribbed net with a circular opening in which the insects which form the food of the Dragonfly are swept up.

The Abdomen. (Plate I.)

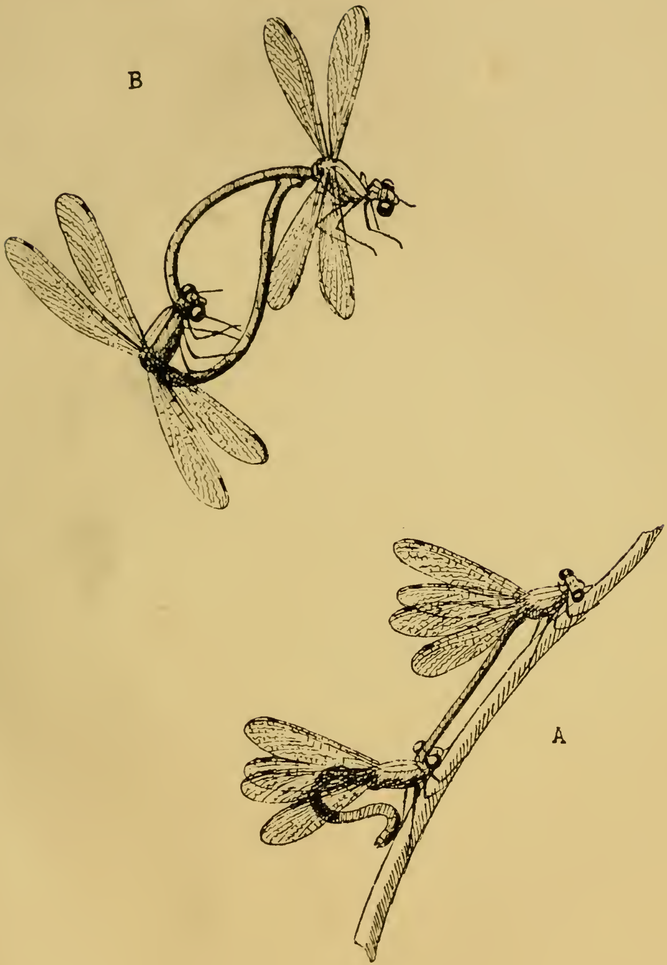
The abdomen is made up of ten segments and is markedly polymorphic. In most of the Libellulines, the abdomen is comparatively short, somewhat depressed or compressed, often tapering from the base to apex, or clavate or fusiform in shape: in the Aeschnines, the base is often more or less tumid and subsequently somewhat constricted, after which it is again slightly dilated and of an uniform thickness as far as the anal end: in the Zygopteridæ, the abdomen is very long and very slim, uniformly cylindrical and with parallel sides: in another genus (Acisoma), the basal segments are much dilated whilst the terminal are extremely attenuated, in some of the Gomphines and a few of the Libellulines, the borders of the 8th and 9th segments may show broad, lateral expansions, whilst most of the former possess a small tubercle on either side of the 2nd segment. The mid-dorsum is often strongly keeled and the ventral surface more or less flat. Along the middle line of the latter, the ventral plates will be seen to be split, their free borders being connected by a delicate, black membrane, the "pleural membrane", which runs from the 3rd to the 8th segment. The ventral plates overhang the membrane, which is tucked in beneath their free or overhanging borders. If a living dragonfly be observed, its abdomen will be seen to rhythmically expand and contract, this movement being permissible owing to the splitting of the ventral plates below and the interposition of the pleural membrane. The function then of this interesting structure is to allow expansion and contraction of the abdominal walls, by which an alternating negative and positive pressure is induced, the effect of which is to suck in and force out, air from the thoracic spiracles.

Thus respiration in the dragonfly is carried out, not by the rising and falling of ribs as in the mammalian thorax but by the relaxation and taughtening of a lax, pleural membrane, the latter being analagous to the mammalian diaphragm.

At the end of the abdomen, the anus opens, three valvular flaps protecting it, and on either side of it, will be found one or two pairs of curious appendages, the "anal appendages". (Plate IX.) These may be very short or very long, foliate, petiolate, saggitate or cylindrical and usually coated with fine hairs. In some species they are present as nipper-like or forcipated processes, closely resembling those seen in the Forficulidæ. Generally in the Anisopteridæ, the inferior appendages are fused to form a single process which is somewhat triangular in shape and often notched at the extremity. In the Agrionidæ, the appendages are very short and inconspicuous although occasionally in some species, they may be abnormally long and forcipated (*e.g.*, *Argia gomphoides*).

The Genital Organs.

Male: The genitals of the male are primary and secondary, the former being situated on the ventral surface of the 9th abdominal segment and the latter on the ventral surface of the 2nd. The primary organ (Plate IX, figs. 2 and 3) is a small papilliform eminence, the "seminal vesicle", lying between the ventral plates of the 9th abdominal segment. It is covered in by two chitinous folds, the "preputial folds", which meet in close contact over it. The seminal ducts open into the seminal vesicle, at the summit of which is an ejaculatory duct or pore, the function of which will be described later on. The spermatozoa are long, spindle-shaped, nucleated cells. The secondary sexual organs are far more complicated structures and the manner in which they functionate, is still very obscure. They consist roughly, of a set of grappling hooks or tentaculæ, a bulb which stores the seminal fluid and a penis which apparently acts more as a swab than as an injecting apparatus. The parts are so diverse in the different species that it is difficult to generalise in describing them as a whole. The "tentaculae," (The "hamecons" of French writers) may consist of an anterior pair of straight or curved hooks and a similar pair of posterior hooks, or either of these pairs may be absent. The anterior pair are directed backward as a rule and the posterior pair forward. In addition to these, in some of the larger species, the Aeschnines, etc., there is a curious, bilaterally, symmetrical organ, the "receptaculum," shaped not unlike the clip commonly used for securing papers in a hanging file. Posterior to it, is found the penis, a very singular and complicated organ which varies considerably in the different species. It is a polymorphic organ lying in the middle line, with a dilated base, a long, narrow stem which is jointed in the middle to allow of the organ being bent on itself, so that when at rest, the bulbous end is in close apposition to its base. (Plate IX. fig. 4, c.). The external surface is horny or chitinous and often grooved transversely and occasionally furnished with minute hooks. The end is bulbous and somewhat fleshy and in the Calopterygines furnished at its neck with long, curving, tapering, membranous processes. (Plate IX, figs. I and XI.) Ordinarily when at rest, the penis is folded upon itself and partially concealed, its bulbous end being interned in a sac-life organ, the "bulb" (Plate IX, figs. 1, 5 and 10. d.) which is a conspicuous object in some of the Calopterygines and Gomphidæ but ordinarily not very evident in the Aeschnines. (Plate IX., fig. 4, d.) The bulb either functionates as a receptacle for the seminal fluid or as a simple sac to protect the fleshy end of the penis. In front of the latter organ and apparently serving to protect it, is another curious grooved hook-like structure, the "sheath," which may also functionate as a director for the penis, preventing over-extension when



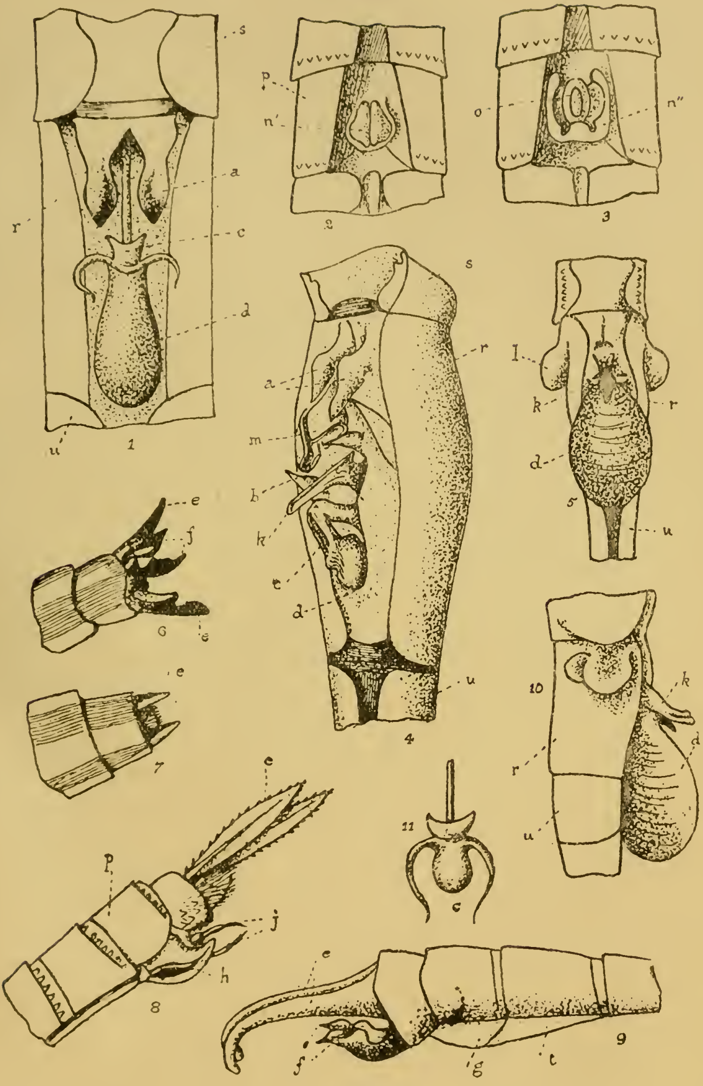
INDIAN DRAGONFLIES.

Agrionines pairing, showing the two acts of copulation.
A.—The male seizing the female by the prothorax.
B.—The female copulating with the male.

Explanation of Plate IX.

1. Male, secondary sexual organs of a Calopterygine (*E. dispar*) Ventral view (× 12).
2. Male primary sexual organs of a Libelluline. Ventral view (× 12).
3. The same, but the preputial folds opened to show the seminal vesicle. Ventral view (× 12).
4. Male secondary sexual organs of an Anax. Semilateral view (× 5·5).
5. Male secondary sexual organs of a Gomphine (× 9).
6. Male anal appendages of an Agrionine (*Argia gomphoides*) (× 10).
7. Female anal appendages of the same (× 10).
8. Female sexual organs and anal appendages of an Anax (× 5·8).
9. Male anal appendages of a Gomphine (7·5).
10. Male secondary sexual organs of a Gomphine (× 10).
11. Penis of a Calopterygine removed from the bulb.

s. First abdominal segment.
r. Second abdominal segment.
u. Third abdominal segment.
p. Ninth abdominal segment.
n′. Preputial folds closed.
n″. Preputial folds opened to show the seminal vesicle.
o. Seminal vesicle.
l. Lateral tubercle or "auricle" found in many Gomphines.
a. Anterior tentaculæ.
b. Posterior tentaculæ.
m. Receptaculum.
k. Sheath of penis.
c. Penis (× 12).
d. Bulb or the vesicle of penis.
e. Superior anal appendages.
f. Inferior anal appendages.
g. Lateral expansion of 9th abdominal segment.
t. Lateral expansion of 8th abdominal segment.
h. Vulvar scale.
j. Tentaculæ or styles.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INDIAN DRAGONFLIES.

Sexual organs and anal-appendages of Dragonflies.

that organ is erect and guiding it along its grooved, under-surface in the act of copulation. All these multiform organs are not present in the whole of the species but as a rule, a pair of tentaculæ, the penis, bulb and sheath may be distinguished.

Female: The female organs, (Plate IX, fig. 8.) are situated on the ventral surface of the 9th abdominal segment. They consist of a "vulvar scale," which is really a paired organ made up of a pair of triangular plates, lying when at rest, either in close apposition or slightly separated and forming a more or less projecting, triangular, wedge-shaped instrument. Concealed between the two plates, in some species, especially in the Aeschnines, lies a long, curved, slim, pointed hook, the "ovipositor," whose functions are probably connected with oviposition as will be hereafter shown. Posterior to the vulvar scale are two pointed bodies, surmounted by a fine brush of stiff bristles. The anal appendages of the female are usually considerably smaller than those of the male.

The methods of Copulation and Oviposition.

The sexual act in Dragonflies is apparently a very complicated one and as yet cannot be said to be correctly completely interpreted.

The first act of copulation is performed by the male, which whilst flying, curves the anal end of its abdomen under itself so as to bring in close apposition, the ventral surfaces of the 2nd and 9th abdominal segments. This act accomplished, it is thought that there is a transference of seminal fluid from the seminal vesicle to the 2nd segment, probably to the part known as the bulb. This act occupies but a brief space of time but the insect may be seen to repeat it again and again whilst hovering in the air. (Note.—I have observed this phenomenon through strong field-glasses and was not altogether satisfied that the act was a sexual one, particularly as I have observed the female performing a similar act, but failing the explanation given, it is difficult to explain how the fluid reaches the 2nd segment).

The female on first emergence from the nymph, has no developed ovæ in its ovaries, these taking some days or possibly weeks to form. During this virginal stage, it retires into the jungle or at least is rarely found in the neighbourhood of water, in which places it is liable to be constantly mobbed by the watching males. The ovaries after a while are observed to be full of ovæ and run the full length of the abdomen, appearing as long creamy, opaque masses. The female now resorts to the neighbourhood of water which is to form the future home of its offspring and here it first makes the acquaintance of the male. Over any pool or river in India there are usually to be seen a large number of Odonata engaged in ceaseless evolutions, apparently seeking for food but in reality on the lookout for females which their instincts tell them must come there to deposit their eggs. The advent of a female is the signal for a rush of the opposite sex to the spot and the selection having been made by the female or fought for by the most robust male, the latter seizes the former by means of its anal appendages, by the prothorax. In some species, the female rests whilst the male hovers over it and seizes it by its appendages, but as a general rule, union takes place in the air. (Plate VIII.) For a time the pair engage in flight, the male apparently towing the female or both flying strongly but after a short time, the second act of copulation takes place. The female now curves its abdomen under that of the male so as to bring its 9th abdominal segment in close apposition with the sexual organs on the under surface of the male's 2nd abdominal segment. A close union takes place by means of the complicated apparatus but an actual penetration does not take place. Whilst linked up in the first stage, the female extrudes a large bunch of eggs from the vulvar orifice, so large in fact that it may easily be discerned as a yellow mass at the anal end of the females abdomen whilst it is flying. A female captured at such a time, will have some scores of eggs extruded, the mass being kept from falling, partly by its inherent agglutination and partly by the vulvar scales which are seen to be gaping and grasping the mass on either side and supporting it from below. In those species which have a lateral dilatation at the sides of the 8th and 9th abdominal segments, it will be seen that these serve a similar purpose as does the vulvar scale. Whilst linked up in the second position, the male works its penis in and out among the mass of ovæ, stirring as it were, the spermatozoa well into it so as to secure complete fertilisation of all the eggs. In some of the Agrionidæ, the prothorax will be found in the female to be fitted with long hooks which apparently assist the male in maintaining its grasp of the female prothorax. Fertilisation having been completed, the insects may or may not sever connection according to the species. In many of the genera it will be found that the male accompanies the female during the process of oviposition and even if not linked up to it meanwhile, will continue to hover over it as if to afford it protection from other males in the vicinity. A male on guard in this way may be seen to tackle and chase away rival after rival, whilst the female pursues its works of oviposition undisturbed. The males of the Agrionidæ accompany the females, maintaining their hold of the latter's prothorax until the eggs have been deposited. The females of this family and of the Aeschnines descend into the water and the former often undergo complete submergence whilst performing the act of oviposition, the male occasionally being also partially submerged. The male Aeschnines betray some anxiety when the females descend into the water and hover restlessly above them until they emerge.

The Aeschnines and Agrionines deposit their eggs on the stems of plants or on pieces of submerged stick or other debris or they may actually embed the ovæ in these objects by means of the strong pointed hook which they carry between the plates of the vulvar scale. The Libellulines may or may not be linked up with the male during the act of deposition but usually they separate for this purpose. They never descend into the water but deposit their eggs on floating weeds or actually drop them on to the surface of the water. They may be seen descending in jerks or repeated, rapid vol-planes, whipping each time the surface of the water with the anal end of the abdomen, until all the eggs have been deposited. Unlike other insects, the pairing of the female with the male is not limited to a single occasion but is a repeated act. Thus a female may be seen to deposit eggs for some time and then link up again with the male, after which, it will deposit a fresh batch and this may be repeated several times.

Eggs are usually deposited in quiet water but many of the Libellulines breed in swiftly running water. Tanks, rivers, stagnant pools and even the mali's reservoir are among the places in which the Dragonfly lay their eggs but no case has been reported where they have bred in sea-water. Occasionally they may be found breeding in brackish water which is rich in chlorides and sulphates but this is exceptional and probably limited to desert forms hard put to it to find a more suitable spot.

The eggs of the Odonata are either small, creamy, opaque objects or they may be of a brownish hue as seen in some of the larger Gomphines. As a rule they are oval in shape but some of the Gomphines are slightly flattened and markedly fusiform in shape. They may be deposited singly or in masses, the latter applying especially to those that descend into the water for the purpose of laying eggs. In these, they appear as long, ropy masses similar but on a smaller scale to those of some of the Batrachians. It is not known how long after deposition, they take to develop, but it appears that there is no definite incubation period, as the eggs of any one particular batch are found to hatch out over a period or succession of days, the eggs on the periphery of the mass being the first to hatch out and so on towards the centre of the batch. Microscopical examination of the eggs shows that they are in different stages of development.

It has already been stated that the majority of the Anisopteridæ deposit their eggs freely in water, the Aeschnidæ and Petalurinæ appearing to be the only exceptions to this rule. It has now been satisfactorily proved that the majority of dragonflies, including the latter two families and the whole of the Zygopteridæ, deposit their eggs actually in the tissues of plants or in decaying pieces of wood in or a little above or in the vicinity of water. As would be suspected, the former class possess a very incomplete ovipositor and their eggs are soft and globular. The latter class on the other hand, have a very highly organised ovipositor and their eggs are of a shape and consistency fitted for their passage into the nest. They have a much firmer shell, are oval in shape and pointed more or less at the extremities.

The ovipositor is a complicated organ consisting of a pair of vulvar scales which functionate partly as a covering for the boring organs and partly as tactile organs for grasping the eggs and guiding them into the holes bored by the other processes. These latter are two paired organs lying between the vulvar scales, one of which is a stillette-shaped process for making the punctures in the stems of reeds and water-plants and the other a saw-like organ for enlarging the punctures to a size suitable for admitting and accommodating the eggs. The vulvar scales are further fitted with small tactile organs or styles which are furnished at their summits with a tuft or pencil of stiff bristles. With these latter, the female insect palpates the stem of the plant for a suitable spot and thereafter makes a series of punctures in a more or less irregular line. Into each hole, one or more eggs are guided by the vulvar scales and stillettes.

In the Moolah River at Poona, specimens of *Micromerus lineatus* and *Argia quadrimaculata* were observed depositing their eggs in reeds which had bent and fallen into the water and were lying flush with the surface, swept by the current but firmly anchored by their stems. Sections of these reeds showed many hundreds of punctures on their surfaces, easily observable with the naked eye as minute black points arranged in very irregular and broken rows. The larvæ from these eggs hatched out on the fifth day, but the incubation period is not always as short and in a colder climate would possibly be of several weeks duration.

The incubation period depends largely on the climate and the temperature and in this country, on the occurrence of the wet and dry seasons. The majority of dragonflies leave the larval state some time before the onset of the rains, this being a natural provision to preserve the species, as most pools are at their lowest ebb and many tanks are completely drying up. The ovæ are deposited in the deeper pools at the onset of the rainy season so that the larvæ are given the fullest time in which to develop before the water supply fails. Although this is stated as a general rule, it is by no means applicable to all the species. In the hills, the imagines are seen to ascend the mountain ravines at the onset of the rains, following the course of the streams and the opposite phenomenon occurs at the end of the wet season. Many of the ovæ deposited in these swift running streams must be carried immense distances before they develop into larvæ.

The Larva.

The young larva on first emergence is enveloped in a filmy skin but this is thrown off as soon as it arrives in the water. Pierre describes one particular species which as soon as it hatches out from the eggs (these being deposited on the stems of osiers, some distance above water level) by a sharp curving or bending of the body, leaps clear of the woody stem and generally falls into the water where it floats belly upwards. Should it however fall on to the muddy foreshore, it will continue to leap about by the same curious contractions of the body until it has made its way down and into the water. The duration of the first instar is said to be extremely short, varying between a few seconds to a few minutes but the subsequent instars of which there are from 11 to 15 are of a much longer duration, some of the later ones lasting for several months. The larval stages are prolonged over a period of a minimum duration of ten months up to a maximum of five years.

The young larvæ live in the interstices of water-weed, preferably in masses of spirogyra or in shallow runlets overlaid by curtains of the same weed. The Libellulines are nearly always found in such situations but as they grow to adult size, they become more bold and may then be seen moving stealthily over the bottoms of deep pools. The Zygopterygine larvæ prefer more open situations such as the borders of tanks or streams, where they may be found clinging to the stems of submerged reeds or water-weed.

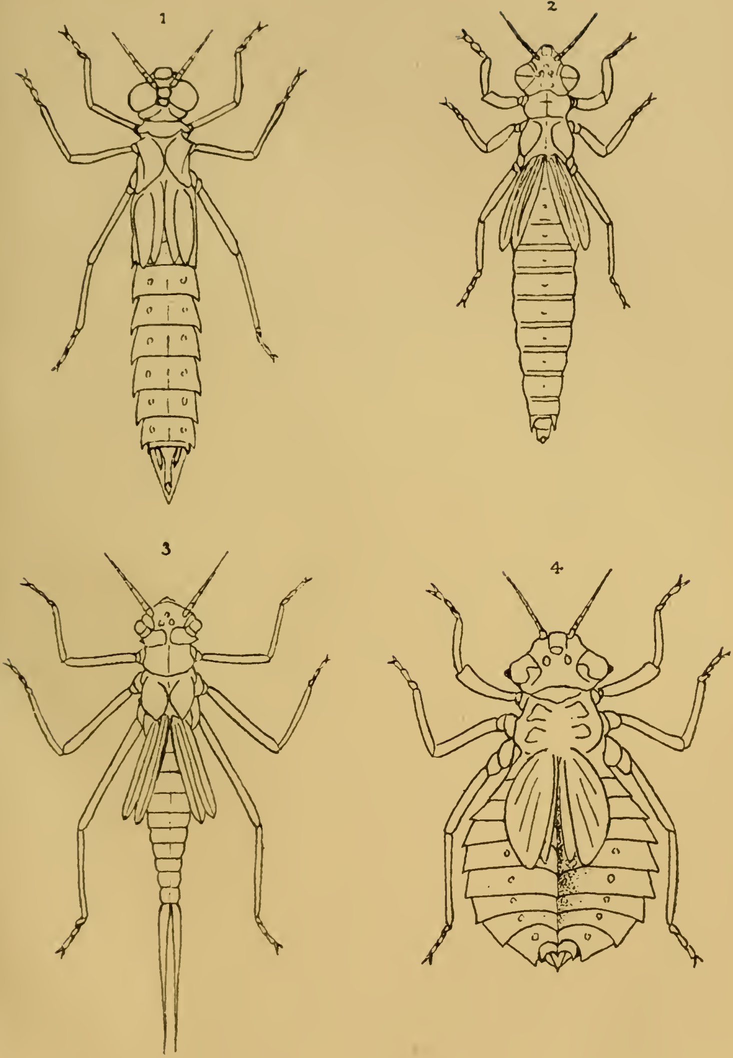
The larvæ of Dragonflies, even in the same genera to a slight extent, are polymorphic but broad differences are only found when comparing the forms of the different families. They may be divided up into several classes according to the shape of their labium but it will be more convenient here to describe them under the same divisions as the imagines.

The Anisopteridæ larvæ (Plates X and XI).

Roughly one of these larvæ may be said to consist of the same parts as does the imago, if we except the wings, anal appendages, and the sexual organs. There is, however, a great difference in the shape of the individual parts and the prothorax and thorax form one solid, fused mass.

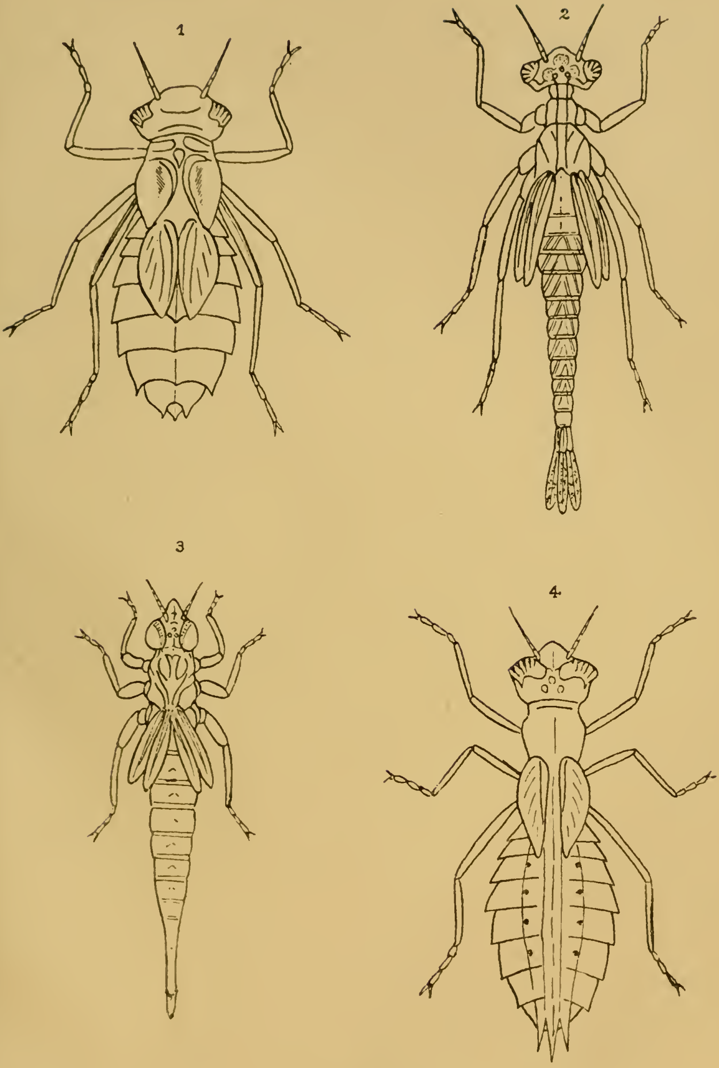
The head is much smaller than in the imago, somewhat quadrilateral in the Libellulines, Aeschnines, Cordulines and a few of the larger Gomphines but more conical as a rule in the latter. It is provided with two large compound eyes, which again, are much smaller than in the imago, and which are invariably well separated. They may form the whole of the side of the head or be confined to the outer and anterior angle only. The eyes may be flat, or rounded, entire or crossed by sutures or their central part raised in a papilliform eminence. In addition to the latter, there are three accessory eyes or ocelli as found in the imago, which are more perfectly developed in some species than in others and which may be, in some, almost obsolete. The ocelli may be mounted on a vesicle or lie flush with the surface between and just in front or behind the eyes proper, and it is very doubtful from their appearance as to whether they functionate in the larva or not. To the inner side and in front of the eyes will be found the antennæ. They possess a much higher development in the larva than in the imago and the segmentation is much more evident, the number of the latter being as a rule, about six.

The mouth is situated on the under side of the head and is furnished with a pair of very massive jaws which are concealed by a jointed, mask-like labium, the "mask." This latter structure is one of the most interesting features found in Dragonflies and is quite unique amongst insects. (Plate XII.) The mask shows considerable differences in shape according to the species, that of the Libellulines being broad, cupped, somewhat foliate and bearing a row of long, imbricated spines, or interlocking teeth along the



INDIAN DRAGONFLIES.

Larvæ of—1. Æschnid (×1·3); **2.** Gomphid (×2·8); 3. Micromerus (×4·5); **4.** Gomphid (×2·2).



INDIAN DRAGONFLIES.

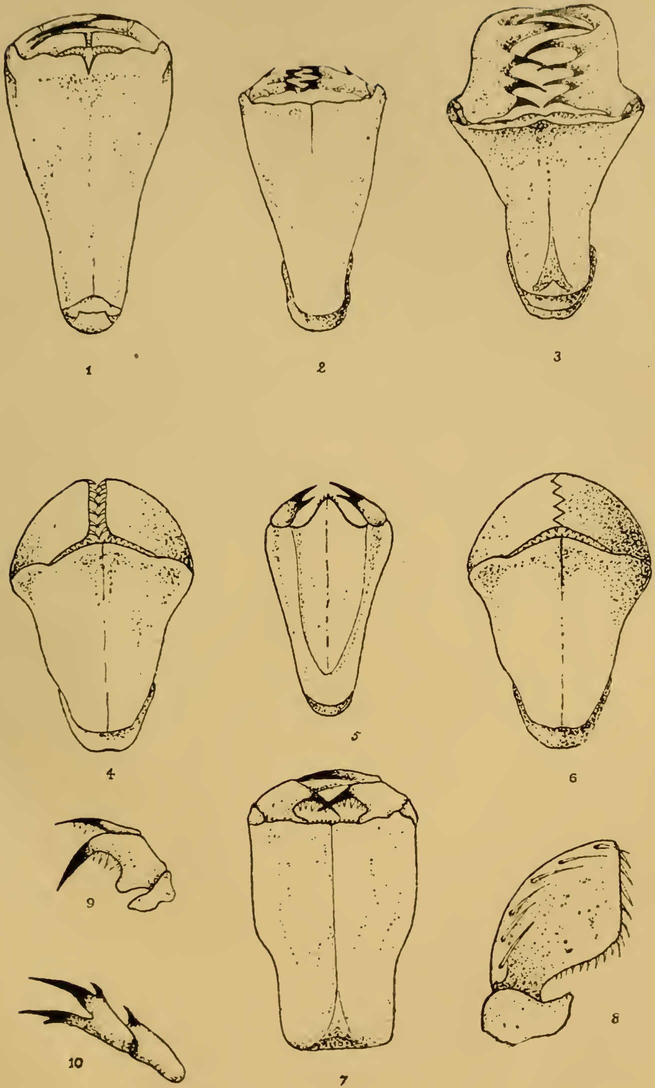
Larvæ of—1. Libelluline (×3) ; 2. Agrionine (×3·5) : 3. Gomphid (×1·5) : 4. Libelluline (×3·0).

INDIAN DRAGONFLIES.

Explanation of Plate XII.

Masks of:—1. Aeschnid (× 4·5).
2. Micromerus (× 14).
3. Cordulia (× 7).
4. Libelluline (× 6).
5. Agrionine (× 12).
6. Libelluline (× 6).
7. Gomphine (× 8·2).
8. The inner side of one of the jaws of 4.
9. One of the jaws of 7 (Gomphine).
10. One of the jaws of 2 (Agrionine).

Plate XII.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INDIAN DRAGONFLIES.

Masks of Dragonfly larvæ.

opposing borders of the jaws: that of the Aeschnines bears a single tooth shaped like a spine on either side of the jaws. These spine-like teeth are so long that they cross and overlap each other across the middle line and almost conceal a pair of membranous, rhomboidal jaws placed below them. The latter are furnished with fine teeth along their opposing borders and that facing the body of the mask. The mask of the Gomphines is much broader at the base than any other species and it is armed with large, bifid jaws which are furnished with a row of sharp teeth or spines along their inner border and which when at rest, cross each other in the middle line. The mask of the Cordulines is the most powerful and the most highly developed. The basal part is triangular, the jaws when placed together form a cup or basket of which the formidable rows of interlacing teeth form the ribs. These jaws are sharply bent or angulated, curving up, to completely cover the lower part of the face. The function of the mask is an exact parallel to that of the tongue of the chameleon. It possesses two joints, one at its attachment to the menton and the other about its middle which enables it to expand forward or to contract back, in which latter situation, in the Libellulines and Cordulines, the cup-like mask situated at its extremity, fits closely over the mouth and its contained jaws. The free end of the mask is furnished with the jaws already described, which fold in and out and when approximated, form a concavity more or less deep according to the species. The function of this organ is to seize insects on which the larva preys and to convey them to its mouth. Normally when at rest the labium is kept carefully folded over the jaws but should an unwary insect pass in the vicinity, it is shot out with incredible swiftness and before one realises it, the insect is struggling in the jaws of its captor.

The prothorax and thorax are fused into one mass; the former being narrower but much broader than in the imago. The thorax is small and at first naked, there being no trace of wings in the first instar of the larva, later however the wing-cases develop and in the final stage are present, either as flat, earshaped objects in the Aeschnines and Libellulines and in some of the larger Gomphines or as long, narrow, cylindrical objects in the latter family. In the Libellulines the forewing-cases entirely cover the hind but in the Gomphines the latter are situated internal to the fore.

The abdomen is made up of ten segments as in the imago and presents wide differences in shape in the different species. In the Gomphines it may be long and somewhat tapering or short, squat and enormously dilated. In the Aeschnines it is narrow, the sides parallel and spined, the dorsum rounded: in the Libellulines there is always a certain amount of dilatation and the dorsum is usually keeled. Larvæ of the Cordulines possess a comparatively short abdomen, greatly dilated and with great development of the dorsal ridge. In some species, on each segment there is a pair of pigmented spots which at first sight appear to be spiracles and which possibly represent the site of atrophied spiracles.

The anal end of the abdomen is furnished either with small valvular flaps as in the Aeschnines, Libellulines, Cordulines, or with a tubular structure formed from the juxtaposition of hollowed-out and modified valvular flaps. This tube, in at least one species of Gomphine, is formed from the last two abdominal segments and is remarkably long and slender with the end bevelled off above in very much the same way as the point of a hypodermic needle. These valves and tubular structures are connected with the respiratory system of the Dragonfly and by their means, water is sucked in and driven out of the rectum. Normally the only means of locomotion is by means of the legs which are long, especially so in the Cordulines, and which do not differ markedly from those of the imago, but should the larva be disturbed, it will at once bring into play the apparatus described above. The action is somewhat of the nature of a turbine, for by driving out forcibly through the valves or tube, the water contained in the rectum, the larva is shot forcibly onward through the water. The force of the expelled column of water is sufficient to stir up a cloud of mud in the immediate rear of the insect which serves to cover its retreat very much in the same way as does the squid with its inky emanations.

The anal appendages of the imago are derived from the anal appendages of the larva but the origin of the inferior appendage of the Anisopteridæ is not analogous to that of the inferior appendages of the Zygopteridæ. If the anal extremity of an Anisopterid larva be examined, it will be seen to present quite a number of appendages. At the extreme end and centrally placed are three pointed processes lying in close apposition to each other and forming what is known as the "anal pyramid." These are the true larval anal appendages and are represented in the Zygoptera by the caudal gills. At the fifth instar, another pair of smaller appendages make their appearance above and to the outer side of the anal pyramid, whilst in the male larva a third appendage or thickening will be apparent lying between these two. When metamorphosis occurs, the following changes take place :—The anal pyramid is entirely lost in the Anisoptera while in the Zygoptera the median portion only is lost, the lateral pieces becoming the inferior anal appendages of the imago. The median process whose late development was commented upon, forms the inferior anal appendage of the Anisoptera males. The two upper lateral appendages ultimately become the superior anal appendages of both the Aniso-and Zygo-pterids.

The Respiratory System.

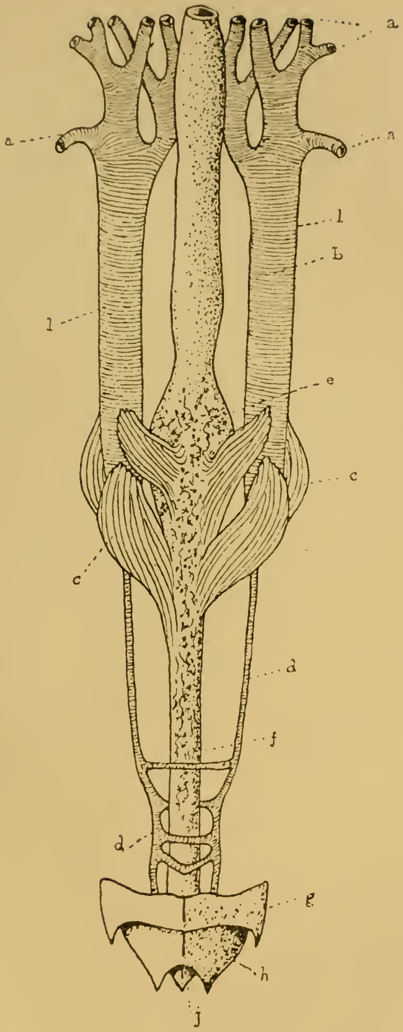
The larvæ of Dragonflies possess a respiratory system fitted to their environment and which afterwards becomes considerably modified in the imago to meet the needs of a life spent in the air. The systems differ in important details and so must be described separately under the two main divisions. The Anisopteridæ larvæ are rectal breathers that is they respire through their rectal lining membrane by a system of rectal gills. The valvular flaps already mentioned above, are opened and through them or through the tubular structure also mentioned, water is taken into the rectum and from it the contained air is extracted and passed on into the air vessels. (Plate XIII.) The rectum extends for about half the length the abdomen and then expands into a large sac-like structure which functionates as a stomach or gizzard. On either side of the alimentary tract runs a large tracheal tube which narrows rapidly as it passes the stomach towards the rectum, to form the bronchus which ultimately breaks up into minor vessels called "bronchi," which latter after anastomosing with those of the opposite side, gradually lose themselves on the end of the rectum. From the main bronchus come off smaller bronchial tubes which pass to the rectum and there break up into a root-like mass on its coelomic surface. These tubes are given off throughout the whole length of the bronchus below the stomach but the larger ones come off in two large masses at the level of that viscus from the lower end of the trachea and run down parallel to the main bronchus before passing to the rectum. The terminals of the bronchi end in small papillæ on the inner lining of the rectum which is studded with an incredible number of these minute processes. If traced above, each trachea will be found to break up into smaller vessels and these again into smaller which ultimately pass to the head, trunk and limbs.

The alimentary tract and the major part of the respiratory system run up in the cœlomic cavity, the space between the body walls and the viscera, which is filled with a pale, green fluid, the blood of the larva.

INDIAN DRAGONFLIES.

EXPLANATION OF PLATE XIII.

1. Trachea.
a. Tracheal tubes.
b. Oesophagus.
e. Stomach.
f. Rectum.
c. Bronchi.
d. Main bronchus.
g. 9th abdominal segment.
h. 10th abdominal segment.
j. Anal valve.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INDIAN DRAGONFLIES.

Respiratory system of an Aeschnine larva (×9)

The Zygopteridæ Larvæ.

These larvæ agree in their composite parts with those of the Anisopteridæ with the single exception of the respiratory organs situated at the anal end of the abdomen but the shape of the various parts differs considerably.

The head is on a much smaller scale (Plate X, figs. 2 and 3), the eyes much further apart and in the genus Micromerus, distinctly conical and broadly rimmed. The ocelli stand out much more distinctly as three reniform bodies, the convexities of which are opposed to each other. The whole insect is more diaphanous and its internal anatomy thereby more apparent. This applies especially to the head in which many interesting structures may be seen, thus two large ganglia, centrally placed, are conspicuous objects from which run branching root-like nerves forward to the antennæ, the "olfactory nerves," and thick cord-like nerves outward to the eyes, the "optic nerves," and lastly two nerve tracts backwards which after traversing the prothorax and thorax, pass back into the abdomen connecting up with a chain of ganglia.

The mask of the labium is more simple than in the Anisopteridæ : in the Agrionines the jaws are furnished with a simple bifid tooth and the anterior border of the end plate is prolonged forward into a triangular projection furnished with minute points. In the Rhinocyphinæ, the mask is very much the same but the jaws themselves are bifid at the end, each arm being furnished with a bifid tooth and there is no projecting anterior border to the end plate. The masks of the Zygopteridæ are never cupped but lie flat, covering in the mouth parts below the head.

The prothorax is much smaller than that of the Anisopteridæ and does not vary very much from that of the imago, its division from the thorax being more sharply defined.

The thorax is longer and narrower and the wing-cases long, narrow and cylindrical and strongly keeled on the dorsum, their shape being very similar to those of the Gomphines. The whole larva is much more attenuated and a more mobile and lithe creature than the larvæ of the Anisopteridæ. The action of the latter is jerky and their progress made by leaps and bounds whilst the movements of Zygopteridæ are more smooth, continuous and lissome like that of a fish or sea-snake, the whole abdomen being brought into play and lashed from side to side as they pass through the water. This action is materially helped by the anal appendages which are found in these species and which form an important part of the respiratory system. In the Agrionines, these are, three, stalked, lamellar-like structures which are shaped differently in the species. Attached advantageously to the hinder end of the abdomen, they perform a secondary function as a propelling organ, serving in the same way as the tail of a fish. The proximal half of these organs is a stalk, through which runs the bronchial tube, the distal part being translucent and containing between its layers the branchiæ which here break up into root-like masses, the extremities of which end in minute, pigmented papillæ. Air is absorbed through these latter and finds its way through the bronchi, which run through the cœlomic cavity and so ultimately to the trachæ by which it is distributed to the different parts of the body. Removal of the respiratory lamellæ does not result in the death of the larvæ as would be expected, so that it is evident that these do not form the only organs of respiration. Very probably the rectum is also used in the same way as found in the Anisopteridæ. In the Rhinocyphinæ, the place of these lamellæ is taken by two long, tapering tubes which are nearly the length of the abdomen. The Euphœa are said to respire by a system of spiracles situated on the abdominal segments, but this and many other points in regard to the working of the various systems of respiration require further investigation ; especially are we in the dark as to how the transition from an aquatic to a life in the air is effected.

The respiratory systems of the larva and imago respectively have already been discussed but a few additional facts need to be added to those descriptions. It has been noted that great changes in the system of respiration occur at metamorphosis and that the rectal or caudal gills of the larva are exchanged for the spiracles of the imago. If the larva be closely examined, it will be found to possess spiracles much the same as the imagos but smaller, less developed and quite functionless.

The spiracles of the imago consist of two sets, one of which is situated on the thorax and the other on the abdomen. On the thorax two pairs of large spiracles are found, an anterior pair on the mesothorax which are largely concealed by the overlapping of the head and prothorax, and a posterior pair which have already been noticed on the sides of the metathorax. The abdominal spiracles are microscopic in character and therefore difficult to see. They will be found on the anterior part of the pleural membrane of the first eight abdominal segments and gradually increase in size from before back, that on the 8th segment being by far the largest. Immediately upon metamorphosis, the rectal gills become functionless, the caudal gills are shed and the spiracular system of the larva becomes the highly developed system of the imago. There is strong evidence to show that the larvæ of dragonflies once lived a terrestrial existence but that with the adoption of an aquatic life, the spiracular system of respiration became temporarily suppressed.

The food of dragonflies both in the larval and imaginal states consists of insects. The former whilst young, live principally on the larvæ of mosquitoes and other small water larvæ : the adult larvæ will however attack fish and are not averse to making a meal off one of their own kind. If a number of these insects be kept in a jar of water together, they will invariably live one on the other. Apparently sluggish in habits, they can on occasion show remarkable activity and what they lack of the latter is amply compensated by their cunning. The perfect insect as a rule is a sun-loving creature but a few species of night-flying Dragonflies are found in India although they are rarely seen and more rarely caught. This is because they have but a very short time of flight, generally not longer than about twenty minutes, at or a little after dusk and again at dawn. The food of these species is apparently entirely limited to mosquitoes.

(Note.—I once noticed one of these night-flying mosquitoes hawking for mosquitoes in the darkened corridor of a government office during the day-time and on other occasions I have seen them flying in the day-time, usually on cloudy or dull days, in the depths of wells.)

One particular species, common enough in the Deccan, has a flight of about one hour daily, from about seven to eight in the evening. A few species inhabit dark jungles and never come out in the sun, whilst others will never fly except on bright sunny days. The males are more usually taken in the neighbourhood of water where they are awaiting the females, the latter being usually taken in scrub or jungle some distance from water. This of course is not universally applicable but it is a general rule and serves to explain why the females are generally so much more rare than the males.

NOTE ON THE PRESERVATION OF COLOURS IN DRAGONFLIES.

One of the great drawbacks of collecting Dragonflies in this country is the alarming rate with which they undergo decomposition, losing as a result their brilliant colouration and often dropping to pieces or shedding their abdomen. With a little practice much of the colouration may be preserved and the decomposition and destruction of the specimens entirely prevented. The whole process of decomposition depends on moisture and the amount of food-stuffs and, in the case of the females, ovae present in the abdominal cavity so that if the latter be removed and the specimen be quickly dried, gratifying results will be obtained.

The insects having been killed in a cyanide bottle, should be dealt with at the earliest opportunity and certainly not later than three or four hours afterward. The pleural membrane is slit up with a pair of sharp-pointed scissors as far as the proximal end of the 3rd abdominal segment and as far posterior as the distal end of the 7th. The incisions should not be carried farther or the sexual organs will be ruined, but if it be found that the abdomen cannot be properly cleansed, as sometimes happens, the incisions may be carried round the outer side of the sexual organs, which thus escape damage. The upper part of the intestine and ovaries are then seized and the whole drawn out by means of a pair of forceps. Very little practice is needed to carry out this simple manœuvre and it will be found that about two dozen can be cleansed within an hour. The specimens should then be mounted on setting boards and placed straight into a drying-tin similar to those used for drying cigars where they may be kept for two or three days for complete desiccation to take place.

Tillyard recommends what will seem to most collectors a far from humane method. He places the live insect in a paper packet and allows it to perish from starvation thus giving it time to get rid of all the faecal contents of its bowel. The mass of eggs in the female cannot however be got rid of so easily. The insects are allowed to die and then set up on boards and dried rapidly by means of a small oven heated by a spirit-lamp. The latter part of his method should be very effective as rapid drying seems so very essential for preserving the colours. In the larger forms, the abdomen having been slit up may be cleansed very easily by holding it under a tap with a good flush of water which will carry away all the contained viscera. Very pretty results may be obtained by painting the insides of the abdominal walls after the specimen is partially dried, and if a living specimen be used as a copy, but the slightest differences will be noticed in the two after the treated specimen has been dried.

Specimens until they have been dried should be carefully bottled up or protected with plenty of napthiline or they will be attacked by a small fly which deposits its eggs in and around the thorax. Maggots rapidly hatch from these and make their way into the tissues of the thorax and ultimately completely ruin the specimen, the colours of which change to a dark brown and the legs and head drop off.

To stiffen the abdomen and prevent it from fracturing off when dried, an old and well-known process, "bristling" should be performed on the insect before drying. Hog's bristles, super-stout horse-hair or very fine copper wire such as silk covered electric cables are made up of, may be used and should be run in between the middle pair of legs and passed through the thorax and carefully on to the end of the abdomen after which the excess in front may be snipped off with scissors.

(*To be continued.*)

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BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON.

REPORT NO. 29, PEGU.

BY R. C. WROUGHTON AND WINIFRED M. DAVIDSON.

COLLECTION ... ... No. 29.
LOCALITY ... ... Pegu.
DATE .. November, 1915 ; May, 1916.
EARLIER REPORTS .. .. No. 1, East Khandesh, Vol. XXI, p. 392, 1912 ; No. 2, Berars, Vol. XXI, p. 820, 1912 ; No. 3, Cutch, Vol. XXI, p. 826, 1912 ; No. 4, Nimar, Vol. XXI, p. 844, 1912 ; No. 5, Dharwar, Vol. XXI, p. 1170, 1912 ; No. 6, Kanara, Vol. XXII, p. 29, 1913 ; No. 7, Central Provinces, Vol. XXII, p. 45, 1913 ; No. 8, Bellary, Vol. XXII, p. 58, 1913 ; No. 9, Mysore, Vol. XXII, p. 283, 1913 ; No. 10, Kathiawar, Vol. XXII, p. 464, 1913 ; No. 11, Coorg, Vol. XXII, p. 486, 1913 ; No. 12, Palanpur, Vol. XXII, p. 684, 1913 ; No. 13, South Ceylon, Vol. XXII, p. 700, 1913 ; No. 14, Shan States, Vol. XXII, p. 710, 1913 ; No. 15, Kumaon, Vol. XXIII, p. 282, 1914 ; No. 16, Dry Zone, Central Burma and Mt. Popa, Vol. XXIII, p. 460, 1915 ; No. 17, Tenasserim, Vol. XXIII, p. 695, 1915 ; No. 18, Ceylon, Vol. XXIV, p. 79, 1915 ; No. 19, Bengal, Vol. XXIV, p. 96, 1915 ; No. 20, Chindwin, Vol. XXIV, p. 291, 1916 ; No. 21, Gwalior, Vol. XXIV, p. 309, 1916 ; No. 22, Koyna Valley, Vol. XXIV, p. 311, 1916 ; No. 23, Sikkim, Vol. XXIV, p. 468, 1916 ; No. 24, Sind, Vol. XXIV, p. 749, 1916 ; No. 25, Chin Hills, Vol. XXIV, p. 758, 1916 ; No. 26, Darjiling, Vol. XXIV, p. 773, 1916 ; No. 27, Bhotan Duars, Vol. XXV, p. 63, 1917 ; No. 28, Kalimpong, Vol. XXV, p. 19.

This Collection, made by Mr. J. M. D. Mackenzie, I.F.S., represents the fauna of the Pegu Forest Division (except for No. 663, *Capricornis sumatrensis milne-edwardsi*, which is from close by), not the Pegu civil district. This area is peculiarly full of species made by Blyth on specimens from the collections of Phayre, Berdmore, Barbe, &c., &c. More representatives of these will be most welcome, and it would be especially interesting to examine series of *Scotophilus fulvidus*, *Hylomys peguensis*, *Mus robustulus* (*Rattus*), *M. concolor* (*Rattus*), *M. badius* (*Vandeleuria*), *M. peguensis* (*Chiropodomys*), *Hapalomys longicaudatus*, and *Lepus peguensis* from this, the type, locality. Very interesting meanwhile are the series of *Tupaia belangeri*, *Tomeutes pygerythrus*, *Menetes berdmorei* and *Mus nitidulus*, which are topotypes of Blyth's species.

The collection contains 237 specimens belonging to 29 species and subspecies in 28 genera. *Tomeutes pygerythrus* has been obtained for the first time under the Survey, having been hitherto represented only by the subspecific form *janetta*. *Petaurista cineraceus*, *Paradoxurus ravus* and *Mungos birmanicus* are also recorded for the first time.

Mr. J. M. D. Mackenzie has kindly furnished the following notes on the area over which he collected :—

" The country lies mostly within, and includes about half of the Pegu civil district ; in the extreme North it goes into Tharawaddy, and in the South into Hanthawaddy. It is a somewhat miscellaneous agglomeration of country, round the town of Pegu. To the North it extends to the Pegu Yomas, and consists of the drainage of the Pegu River. Twenty-five miles North of Pegu, the Eastern boundary crosses to the Sittang River, meeting it at the mouth of the Pegu-Sittang Canal. From there to the sea-coast, the Sittang River is the boundary. On the West, the boundary runs down the Pegu Yomas from the North, up to some 20 miles North of Pegu. From there it follows a stream until it comes into the Pegu River some 15 miles below Pegu ; thence along the Pegu and Rangoon Rivers to the mouth of the latter, excluding the town of Rangoon. From the mouth of the Rangoon River to the mouth of the Sittang River it follows the sea-coast, including the Western part of the Gulf of Martaban. The area is roughly 140 miles from North to South, and 25 miles from East to West, going to a point in the North and being slightly wider in the South, and represents, partially at any rate, the fauna of Central Burma, connecting up S. Tenasserim with the three areas worked by Shortridge in the North.

" The area admits of division into two distinct types, with an intermediate area between. From 30 miles North of Pegu to the Northern limit, the country consists of nothing but forest reserves, that is, jungle containing large trees, *e.g.*, teak and ironwood, with considerable areas of bamboo, more or less pure. There is practically no permanent cultivation or level land in this area, which is inhabited by only a few Karens (about 1,000), practising 'Taungya,' or shifting cultivation, within specified areas. (See Report No. 25). It consists of steep, broken hills of no great height (the highest is some 2,000), thickly wooded.

" From 30 miles North of Pegu to the level of Pegu, there is scrub jungle, sometimes replaced by reserves containing big trees in some parts, and permanent (wet) paddy cultivation in others. This area contains a considerable population, and there is very little more room for cultivation. A good deal of Taungya cutting is done by men who cannot get fields.

South of Pegu to the sea, the country is one vast paddy plain. On it everything is subordinated to paddy. There is no fuel or timber, and only such grazing as is enforced. The only trees are those round villages (rain-trees generally) and a few plantations made by the Forest Depot. On such lands nothing lives but bandicoots, rats and mice. This flat Delta land covered with paddy continues up to the sea-coast—or to within a few miles of it, where it is replaced by scrub jungle. In this belt there are considerable areas of reserves where tidal or coastal forests were originally protected.

" Every year the Sittang River continues the process of extending the Indian Empire, increasing it by silting up about another mile of sea. In the first year, this grows a crop of a coarse grass called 'Pinle Saba' (sea paddy) which is replaced next year by tidal shrubs, which are in turn gradually, and by fairly definite stages, replaced by scrub jungle. This is grazed down and cut for fuel by villagers until it has taken the salt out of the soil, and can be replaced by paddy fields.

" The annual extension seawards is about half a mile to a mile, and, when the scrub jungle has disappeared, it produces some of the finest paddy land in the world.

" The whole area is inundated throughout the rains (travelling is done by sampan), and the seaward part of the scrub jungle belt is covered with salt water every high tide. This brings up mud, fills in all cracks, and gradually raises the level of the land until it is above tide level. After that a deposit of mud is laid down every year in the rains, and in this way the salt is washed out of the soil and the level raised until it becomes paddy land. The tidal forest belt is from four to ten miles wide, and consist of dense thickets of various bushes which will grow in salt swampy localities.

" The above somewhat lengthy dissertation is required to understand the distribution of species in the district. In the North the usual fauna is found. That in the South consists, apart from bats, which are not common, of rats and mice (the terms are not used scientifically), which live in the paddy-fields while they are dry, and presumably in villages in the rains, and of the animals living in the coastal jungle belts, *e,g.*, Viverriculæ, and cats of various descriptions, thamin (brow-antlered deer), hogdeer, and pig, I have seen the last two, but cannot vouch for thamin. . . . One spot is called 'Singyum' (Elephant Island), and various 'oldest inhabitants' say that 60 or 70 years ago elephants were not rare down there. There are no squirrels, bamboo rats, or tupaias, and I was unable to hear of any monkeys."

Mr. Mackenzie adds the following notes on species of which he failed to obtain specimens :—

" *Macaca sp.*—Vernacular name.—Karen—TA-U.

" *Viverra sp.*—Vernacular name.—Karen—SHAW.

" *Muntiacus grandicornis*—Vernacular name.—Karen—DACHOH or TACHEE (*ch* soft.)

" *Cervus porcinus* and *C. eldi.*—Occur. See my note on the Delta area. Vernacular names.—Karen—DACHYEH and THAMARONG.

"*Rhinoceros sp.*—Have found absolutely fresh tracks, but have not shot one. Very local. I think it is always a local animal in the most restricted sense. It lives for a week, a month, or considerably longer in an area of, say, three to four square miles, then moves to a considerable distance, returning, often after three or four moves, to the original locality. I know a small area in the Pegu Yomas where a Rhino has lived for at least eighteen months. Old and fresh tracks had been found at Christmas, 1914, and I found fresh tracks, and tracks from the 1915 rains, in January, 1916. With regard to Mr. Shortridge's notes, II, J., B. N. H. S. XXIII, No. 4, I have seen tracks of four Rhinos together, and have been told by a sahib that he has seen six of these animals together. So it seems that they are at times gregarious, though generally met with singly. (Any notes on this would be very interesting. The reason may be seasonal, connected with food or water, or possibly with visits to a salt lick)........ I have several times followed up tracks, and have never seen a case of a pair meeting during the night, as mentioned by Shortridge; nor have I ever heard of the habit from Chins or Burmans, some of whom are very close observers, especially of Rhino, which are worth from Rs. 1,000 to Rs. 1,500 to a native shikari. Every part of the animal is saleable. A good horn alone is worth from Rs. 800 to Rs. 1,000, and almost any horn is worth from Rs. 400 to Rs. 500.

Vernacular name.—Karen—DA DU CHAW.

Sus sp.—Vernacular name.—Karen—TOH (*o* short).

Elephants.—Fairly common in parts. That is, I suppose there are 60 to 80 wild elephants in the whole district, all North of Pegu. I walked up to a fine onmusth (tuskless male) which had been causing trouble among tame elephants. It was reported to be a tusker, and neither I nor the man who was with me, Mr. Roy of Messrs. Foucar and Co., fired at it .... We first met it about 300 yards from camp, on a narrow path, but it bolted without being properly seen. About two miles further on we saw it, and it came walking slowly down the path towards us. Apparently it had not seen us, for when it did, it turned and bolted.

Vernacular name.—Karen—RHASAW.

Bibos gaurus.—Moderately common, but local.

Vernacular name.—Karen—SUERH or BAWKAW ('Yellow legs').

Bibos sondaicus (Saing).—Local. More common on the whole than the bison, but much shyer. It does considerable damage in teak plantations. Grass springs up after the first rains, as they are open. The Saing comes in considerable numbers to feed on this, and when bored with grass, barks the young teak.

Vernacular name.—Karen—BAWHUERH ('Yellow horns').

Felis tigris.—Vernacular name.—Karen—BAWTHOO.

F. pardus.—Vernacular name.—Karen—OHAY BWHAY (*ch* soft).

Ursus torquatus.—Occurs.

Lepus peguensis.—Have been unable to hear of any round Pegu. The specific name was probably given to specimens from Burma—say, Rangoon—before that town became important, and when Pegu practically meant British Burma. (*Cf.* the 'Pegu Pirates' and 'Pegu Club' in Rangoon).

1. PITHECUS PHAYREI, Blyth.

Phayre's Leaf Monkey.

(Synonymy in No. 14.)

S. Zamayi Res. (60 miles N. of Pegu) ♂ 1; Kadat (60 mi. N. of Pugu) ♂ 1 (no skull) ♀ 1 (no skull).

(*See* also Reports Nos. 16, 20 and 25.)

Fairly common in the hills. Goes about in flocks. After a flock has been frightened and has run away, an elderly member, generally a male, often stays in a high tree, and swears at the intruder, or keeps a watchful eye on him. Flesh eaten, especially by Karens. Burmans say monkey flesh is a very strengthening food, especially in certain diseases.

Vernacular names.—Burmese—MYETKWIN BYU; Karen—TA THWAW.—J.M.D.M.

2. NYCTICEBUS COUCANG, Bodd.

The Slow Loris.

(Synonymy in No. 17.)

50 miles N. of Pegu ♀ 1.

(*See* also Report No. 25.)

I have a pair, a female and a young one, in captivity. They were caught roosting among thick foliage.—J. M. D. M.

3. PTEROPUS GIGANTEUS, Brunn.

The Common Flying Fox.

(Synonymy in No. 2.)

Pegu, ♂ 1, ♀ 2.
(*See* also Reports Nos. 2, 3, 4, 5, 7, 8, 9, 10, 12, 13, 15, 18, 19, 22, 23 and 27.)

Common in Pegu town. I have been unable to find where they roost. Their flight is most deceptive, and they are very difficult to shoot on the wing at dusk.

Vernacular names for all large bats.—Burmese—LIN SWAY; Karen—PLAKE PLA.—J. M. D. M.

4. MEGADERMA SPASMA TRIFOLIUM, Geoff.

The Malay Vampire Bat.

(Synonymy in No. 5.)

Zaungtu (34 mi. N. of Pegu), ♂ 2, ♀ 1 in al. 5.
(*See* also Reports Nos. 6, 11, 13, 16, 17, 18 and 20.)
These bats were all shot hanging from the roof of the F. D. bungalow at Zaungtu.—J. M. D. M.

5. TYLONYCTERIS FULVIDA, Blyth.

The Pigmy Club-footed Bat.

(Synonymy in No. 23.)

Dawé (45 mi. N. of Pegu), in al. 4.
(*See* also Reports Nos. 14, 17, 20, 25, 26 and 28.)
"Shot flying over rivers in thick jungle at dusk. Very common."—J. M. D. M.

6. PIPISTRELLUS COROMANDRA, Gray.

The Coromandel Pipistrel.

(Synonymy in No. 5.)

Pegu, ♂ 1, in al. 6.
(*See* also Reports Nos. 2, 9, 11, 13, 14, 15, 19, 23, 26, 27 and 28.)

"No. 495 was found at midday roosting between the flaps of my Punkah. Nos. 494, 505 and others were killed at night flying round my room, and in friends' houses.

"Vernacular name for all small bats.—Karen-PLA or BLA."—J. M. D. M.

7. SCOTOPHILUS KUHLI, Leach.

The Common Yellow Bat.

(Synonymy in No. 1.)

Pegu, ♀ 4, in al. 3; Thanatpink (7 mi. S. of Pegu), in al. 1.

(*See* also Reports Nos. 1, 3, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 19, 20, 23, 24 and 27).

8. SCOTOPHILUS WROUGHTONI, Thos.

Wroughton's Bat.

(Synonymy in No. 1.)

Pegu, in al. 1.

(*See* also Reports Nos. 1, 3, 5, 6, 7, 9, 12, 14, 15, 16, 18, 19, 23 and 27.)

9. TAPHOZOUS LONGIMANUS, Hardw.

The Long-armed Sheath-tailed Bat.

(Synonymy in No. 6.)

Pegu, ♂ 2, in al. 6; Sitpinzeik, ♂ 1, ♀ 1.

(*See* also Reports Nos. 7, 8, 9, 12, 16, 17, 19, 20 and 22.)

"Nos. 510 and 514 seem to differ in colour from similar bats in the Collection. All those obtained from Sitpinzeik Rest House were similar. —J. M. D. M.

10. TUPAIA BELANGERI, Wagn.

The Burmese Tree-Shrew.

(Synonymy in No. 17.)

Pyinbongyi Res. (20 mi. N. of Pegu), ♀ 1; Dawe, (50 mi. N.), ♂ 2; S. Zamayi Res. (6 mi. N.), ♀ 1 (65 mi. N.), ♂ 1; N. Zamayi Res. (80 mi. N.), ♂ 1.

"Common, but not often seen except in the hot, dry weather. I came up one path for 40 miles and saw dozens, in April. While I was in camp the other end, it rained heavily on four or five days, and on the way back, when the ground was wet and I wanted specimens, I could not shoot one. I saw only three or four the whole way. The same applies to *Menetes berdmorei*. The local explanation is that the wet both brings out insects, &c., and softens the ground, making them easy to dig for, and so Tupaias, &c., and creep about in holes and under logs and stones, instead of having to push round on the suface and up and down tree-trunks. This seems possible, but the Karen is not nearly such a clever observer as the Chin."

"Vernacular name.—Karen—CHEH (*ch* as in 'nicht')."—J. M. D. M.

11. PACHYURA, sp.

The Musk Rat.

Pegu, ♂ 2, in al. 4; Thongwa (40 mi. S. E. of Pegu), ♀ 1.

(*See* also Reports No. 1, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 22, 23, 26 and 27.)

12. VIVERRICULA MALACCENSIS, Gmel.

The Small Indian Civet.

(Synonymy in No. 3.)

Sittong R, Delta, ? sex, 5.

(*See* also Reports Nos. 5, 7, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25 and 27.)

"Shot in the Delta forests"—J. M. D. M.

13. PARADOXURUS RAVUS, Miller.

The Malayan Palm-Civet.

1891. *Paradoxurus hermaphroditus*, Blanford, Mammalia, No. 52. (*partim.*)

1913. *Paradoxurus hermaphroditus ravus*, Miller, Smithsonian Misc. Coll. Vol. 61, No. 21, p. 2.

N. Zamayi Res. (80 mi. N. of Pegu), ♂ 1.

"Shot at dusk in a tree.

"Vernacular name.—Karen—TOK TOH (*o*. in Tok short)."—J. M. D. M.

14. ARCTOGALIDIA LEUCOTIS, Blyth.

The Small-toothed Palm-Civet.

(Synonymy in No. 17.)

S. Zamayi Res. (60 mi. N. of Pegu), ♂ 1.

"Shot in a high tree at dusk. Stomach empty; intestines contained fruit of some *ficus*. I shot two together, but the other could not be found.

"Vernacular names.—Burmese—THIT TE KYEE; Karen—TAW HSEE." —J. M. D. M.

15. MUNGOS BIRMANICUS, Thos.

The Small Burmese Mungoose.

1886. *Herpestes auropunctatus birmanicus*, Thomas, A. M. N. H. ser. 5, XVII, p. 84.

1891. *Herpestes birmanicus*, Blanford, Mammalia, No. 59.

Sittang R. Delta (40 mi. N. of Pegu), ? sex, 1.

16. HELICTIS PERSONATA. Geoff.

The Burmese Ferret Badger.

(Synonymy in No. 16.)

Pegu, ♂ 1.

"Caught in a garden just outside Pegu. The stomach contained beetles, flies, some kind of debris (roots, I think), and five or six earthworms, swallowed whole, or bitten into two or three pieces only."—J. M. D. M.

17. URSUS MALAYANUS, Reffl.

The Malay Bear.

N. Zamayi Res. (70 mi. N. of Pegu), ♀ 1.

This specimen was not sent. It was shot in the extreme North of the Pegu district, on the Pegu-Tharawaddy border, where, it is interesting to note, Blanford says it is not found.

18. PETAURISTA CINERACEUS, Blyth.

The Tenasserim Brown Flying Squirrel.

1847. *Pteromys petaurista*, var. *cineraceus*, Blyth, J. A. S. B. XVI, p. 865.

1891. *Pteromys oral*, Blanford, Mammalia, No. 227. (partim).
70 mi. N. of Pegu, ? sex, 1 (no skull).
A large flying squirrel, resembling *P. philippensis*.
"Brought in by a forester.
Vernacular name.—Karen—Blee or Balee (*a* short)."—J. M. D. M.

19. Ratufa phoeopepla marana, Thos. and Wr.

The Central Burmese Giant Squirrel.

(Synonymy in No. 16.)

S. Zamayi Res. (65 mi. N. of Pegu), ♀ 1.
"Not common.
"Vernacular names.—Burmese—Linthet; Karen—Dabaw Kaw."—J. M. D. M.

20. Callosciurus ferrugineus, F. Cuv.

The Burmese Bay Squirrel.

(Synonymy in No. 16.)

Shovelaung (20 mi. N. of Pegu), ♀ 1; Daingmhu (40 mi. N.), ♂ 1; Zaungtu (34 m. N.), ♂ 1, ♀ 3 (two skins and three skulls); (40 mi. N.), ♀ 1; Dawe (45 mi. N.), ♀ 2; N. Zamayi Res. (70 mi. N.), ♂ 1; S. Zamayi Res. (40 mi. N.), ♀ 2; (60 mi. N.), ♀ 1; Aungmya (35 mi. N.), ♂ 1; Tamabin (27 mi. N.), ♂ 1.

"Common. Varies considerably in shade, some being light red, almost yellow, and some almost black. This does not appear to be seasonal. They always appear to have a white tail-tip, though I got one (No. 649) with the white hairs tipped with rufous, West of the Pegu River. *C. ferrugineus* and *R. phæopepia marana* never come down to the ground, and generally like a good high tree. *Callosciurus* comes down to a lower level than *Ratufa* generally does.

"Venacular name.—Burmese—Shing Apaw. (At Kindat, *Ratufa gigantea* is called this."—J. M. D. M.

21. Tomeutes pygerythrus, Geoff.

The Irrawaddy Squirrel.

1832. *Sciurus pygerythrus*, Geoffroy, Mag. Zool. 1832, Cl. 1.
1891. *Sciurus pygerythus*, Blanford, Mammalia. No. 248.
Pegu, ♂ 1; Zaungtu (30 mi. N. of Pegu), ♀ 1; Tamabin (25 mi. N.), ♂ 3, ♀ 1; (27 mi. N.), ♂ 3; N. Zamayi (80 mi. N.), ♂ 1; S. Zamayi (45 mi. N.), ♀ (? ♂ juv.), 1.

"Commonest on low ground, and near villages. I have shot one in heavy jungle, on a high ridge. It appears to be indifferent to height, as it will run across an open space or up a high tree. It never seems to go to the top of the highest trees unless shot at.

"Vernacular name.—Karen—Lee Pa—Aw."—J. M. D. M.

22. Menetes berdmorei, Blyth.

Berdmore's Sqirrel.

(Synonymy in No. 17.)

(45 mi. N. of Pegu), ♀ 1; Dawe (50 mi. N.), ♀ 1 (skull missing); N. Zamayi (70 mi. N.), ♀ 1; S. Zamayi (60 mi. N.), ♀ 1; (65 mi. N.), ♀ 1: Kadat (40 mi. N.), ♂ 1; (60 mi. N.), ♀ 1.

"A ground squirrel (see note on *Tupaia*). This squirrel seems to prefer the ground, or bamboos or branches lying on or close to the ground. I have never seen it in a high tree (*i. e.*, over 10 high)."—J.M.D.M.

23. MUS NITIDULUS, Blyth.

Berdmore's Mouse.

(Synonymy in No. 1.)

Pegu, ♂ 1, in al., 43; (16 mi. S.E.) of Pegu, ♂ 3, ♀ 5, in al., 6; Vitkangale (12 mi. S.E.), ♀ 1, in al., 5; Kyinigyaung (40 mi. S. E.), ♂ 4, ♀ 1 in al., 7; Swedawchaung (40 mi. S.E.), ♂ 1, ♀ 2, in al., 12; To laingma Res. (25 mi. N.), in al., 1; Rangoon, ♂ 1.

(*See* also Reports Nos. 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22, 25 and 27.)

"All rats and mice except Nos. 655 (*Rattus rufescens* var.) and 656 (*Mus nitidulus*) caught in houses and paddy-fields in the Delta. They make large and fairly deep holes in the kagins (bunds) between the paddy-fields, in the hot and cold weather. The entrance can be easily found by the pile of excavated earth lying in front. I do not know where they go in the rains; into houses, I expect, and up trees, as the whole area is flooded."—J. M. D. M.

24. RATTUS RUFESCENS, var.

Pegu, ♂ 1, ♀ 1, in al., 2; Tolaingma (25 m. N.), ♀ 1; (40 m. N.), in al., 6; Swedawchaung (40 m. S.E.), ♂ 1, ♀ 1; Kyinigyaung (40 m. S. E, Pegu), ♀ 1.

"Nos. 655 and 656 were caught in a hole in the jungle. I was out doing 'a job of work' in the middle of day, when I saw this rat running along the ground. I had a snap shot at her, but she streaked into a hole, about a foot across. On investigation I found two or three tunnels running from it, and one of my men saw her go down one of these, and we got busy. After a bit he saw something move, and rashly put his hand in; he brought it out again quickly with a yell that he had been bitten by a hamadryad. Luckily it was only a very big rat-snake, eight or nine feet long which contained the mangled remains of four or five young rats and No. 656. No. 655 was found hiding down another passage, and duly extracted and killed. The nest containing the young and the snake was made entirely of dry leaves, some of which appeared to have been put in green.

"Vernacular names.—Karen—YU or YUERH. Big field rats—YU TEA. House mice—YU WA CHER HER (ch soft)."—J. M. D. M.

25. GUNOMYS VARIUS. Thos.

The Malay Mole Rat.

(Synonymy in No. 17.)

Vitkangale (12 m. S. E. Pegu), ♂ 3 (and one skull), ♀ 3; (13 m. S.E.), in al., 1.

26. BANDICOTA NEMORIVAGA, Hodgs.

The Smaller Bandicoot Rat.

1836. *Mus (Rattus) nemorivagus*, Hodgson, J.A.S.B. V., p. 234.
1863. *Mus bandicota*, Blyth, J.A.S.B. XXXII., p. 333.
1891. *Nesocia nemorivaga*, Blanford, Mammalia, No. 297.

Vitkangale (12 m. S.E. Pegu), ♂ 2, ♀ 4; (13 m. S.E.), ♂ 2; Kyinigyaung (25 m. S.E.), ♀ 1; (30 m. S.E.), ♀ 4; (60 m. S.E.), ♀ 1.

27. CANNOMYS PATER, Thos.

Popa Bamboo Rat.

1842. *Rhizomys badius*, Hodgson, Calc. Journ. N. H. II, pp. 60, 410.
1843. *Ryzomys castaneus*, Blyth, J. A. S. B. XII, p. 1007.
1891. *Rhyzomys badius*, Blanford, Mammalia, No. 312. (partim.)
1915. *Cannomys pater*, Thomas, A. N. M. H. ser. 8, Vol. XVI, p. 313.
Dawe (50 m. N. of Pegu), ♀. 1.

28. CAPRICORNIS SUMATRENSIS MILNE-EDWARDSI.

The Sze Chuen Serow.

Shwegyin (probably); bought in Pegu bazaar, frontlet and part of skull only.

(*See* also Report No. 17. Supp.)

" One pair of horns sent, bought in the bazaar. Serow do occur in the district, but are rare. I think this pair of horns came from Shwegyin, N. W., on the other side of the Sittang.

" Vernacular name.—Karen —TA PA."—J. M. D. M.

29. MANIS AURITA, Hodgs.

The Eastern Pangolin.

(Synonymy in No. 16.)

(40 m. N. of Pegu), ♀ 1 (imm.).

" Caught walking along a path at dusk.

" Vernacular names.—Burmese—THINGWAY KYAT ; Karen—YO-HAW."—J. M. D. M.

HERBACEOUS MONSOON FLORA AT CASTLE ROCK AND A NEW SPECIES OF BALSAM.

BY

L. J. SEDGWICK, F.L.S., I.C.S.

The flora of the Western Ghats has been well explored in the dry season, but very little in the monsoon. The present visit to Castle Rock was made in the second week of August 1917. With the writer were Messrs. T. R. D. Bell and P. F. Fyson. The visit was necessarily a short one, and the plant collecting work was too arduous to leave any time for an oecological analysis of the formations. Castle Rock is well below the water shed and well under 2,000 feet elevation. The rainfall is excessive, 250-300 inches or more. It would vary from point to point, so the exact average of any one gauge is immaterial. The following notes relate to herbaceous monsoon flora only:—

GERANIACEÆ.

Impatiens acaulis, Arn.

A beautiful plant, growing on stone faces, such as culvert walls, and occasionally on the lower parts of tree trunks. Gregarious when it occurs, and owing to its large and handsome flowers very conspicuous. The plant dries to the merest transparent film.

I. oppositifolia, Linn.

Extremely abundant in the opener places. Its peculiar feature is the wide range of colour exhibited by its flowers. The commonest colour is a curious shade of deep brick-red. But within a few square feet will be found twenty or thirty different shades from rose pink and salmon pink, to deep vermilion and crimson. This point is rather important, as colour is sometimes used in the systematic analysis of the genus.

I. kleinii, Wt. and Arn.

Very abundant.

I. sp. nova, near to *kleinii*.

Below will be found a full account of this plant. By the Railway line and elsewhere. Not nearly so common as *I. kleinii*, but closely associated with that species.

BEGONIACEÆ.

Begonia crenata, Dryand.

Very common on stones in forest.

Begonia concanensis, D.C.

Only observed in one place, at the foot of a steep bank, hidden by other vegetation. A much larger and more robust plant than *crenata*.

RUBIACEÆ.

The prevalence of Rubiaceous herbs is certainly one of the features of the monsoon flora.

Argostemma courtallense, Arn.

On stone faces beside a stream in forest. A plant of dense shade.

Argostemma verticillatum, Wall.

On stones in streams, culvert walls, &c., common, and gregarious where it occurs. A delicate and beautiful plant with spreading filmy leaves, and white, star-like flowers. This plant is recorded in Cooke's Flora B. P. as occurring "on trees in the Wari Country," *fide* Dalzell. It is not, however, an epiphyte. Like *Begonia crenata*, *Impatiens acaulis*, &c., it prefers rocks and stones, but will accept the base of a tree as a substitute. It is a plant of wide distribution, within the Indo-Malayan area, occurring at suitable elevations and humidity along the Himalayas from Kumaon to Sikkim, in Assam, Burma, and Penang.

Hedyotis auricularia, Linn.

On the ground, prostrate, common. Hardly worth mentioning except to note its general resemblance to *Spermacoce hispida*, with which it is liable to be mistaken.

Oldenlandia diffusa, Roxb.

In a damp place on a path in forest.

Anotis rheedii, Benth. and Hook.

Very abundant in opener places.

A. quadrilocularis, Hook. f.

Apparently rather a rare plant in the Presidency, but common at Castle Rock.

A. foetida, Benth and Hook.

Very common.

Opphiorhiza harrisiana, Heyne.

Common. An extraordinarily variable plant. The maximum length of leaf given by Cooke is 2½″ and by Hooker 4″, but some of our plants have leaves 5″ long. In one case the flowers are pseudo-racemosely disposed along the cyme branches; in another they form a perfect corymb. The undersurface of the leaves is either green, grey or pink. In no case are the plants with numerous branches as described by Cooke. They are usually simple.

LENTIBULARIACEÆ.

Utricularia arcuata, Wt.

In one clearing in the forest on sheet rock. A handsome plant. Corolla with a yellow eye, ringed round with white, and outside that pale blue.

Utricularia affinis, Wt.

On rocks and gravel, common. Flowers much smaller, and of a much darker and more lurid blue than *arcuata*.

Utricularia striatula, Sm.

Very common both on stone faces and on trees, growing well up the tree, and not only at the base. The corolla varies from pale violet to pure white, with a yellow eye.

GESNERACEÆ.

Epithema carnosum, Benth.

On the face of one culvert.

A second Gesneraceous plant with a filmy unequal-sided leaf was coming on at the ends of a railway tunnel.

SCROPHULARIACEÆ.

Torenia bicolor, Dalz.

With *Oldenlandia diffusa* (q. v.)

LABIATÆ.

Scutellaria discolor, Coleb.

On a bank.

URTICACEÆ.

Fleurya interrupta, Gaud.

Edges of the forest.

Elatostemma lineolatum, Wt.

Forming great bushy patches by the side of a stream in dense shade in forest.

ORCHIDACEÆ.

Habenaria subpubens, Rich.

Very common in grass.

Habenaria stenostachya, Benth.

In a natural clearing in the forest, on sheet rock. This elegant orchid is not mentioned by Cooke in F. B. P. but as Hooker gives Deccan peninsula from the Concan southward, its discovery within our limits is not unnatural.

Liparis nervosa, Lindl.

Peristylus goodyeroides, var *affinis*, Lindl.

One plant of each by forest edges.

Microstylis versicolor, Lindl.

Very common at one point in forest, on and by exposed boulders in dense shade.

SCITAMINEÆ.

The prevalence of Zinziberaceous plants is one of the most conspicuous features of these Ghat forests during the monsoon.

Zinziber nimmonii, Dalz.

Z. cassumar, Roxb.

Both common in the opener forest.

Costus speciosus, Smith.

Not uncommon.

CYPERACEÆ.

Scleria elata, Thw.

This splendid plant, which grows in a nallah near the Salt Bungalow at Castle Rock, is not mentioned by Cooke. It is widely distributed throughout India, and its discovery within our limits is therefore not unnatural.

Most of the above plants are definitely monsoon plants, and of them the following:—*Inpatiens acaulis*, *Begonia crenata*, *Argostemma* both spp., *Epithema carnosum*, the other Gesneraceous plant noted as coming on and *Utricularia striatula* represent a fugacious class of hygrophytes, which do not root in earth at all, but attach themselves to crevices of stones and trees, and subsis ton the constantly changing surface moisture. They all of them dry to transparent films, and an investigation of the cytology of their leaves would probably show that there is practically no differentiated epidermis, and large inter-cellular spaces.

Below will be found a note showing the differences between the new species of *Impatiens* and *I. kleinii*.

A NEW SPECIES OF BALSAM.

I. KLEINII, *Wt.* and *Arn.*	IMPATIENS, SP. NOVA.
Habit—2-12 in. high.	Habit—8-14 in. high.
Leaves—	Leaves—As in *kleinii*, but usually longer and more parallel-sided;
shortly petioled;	lower leaves almost sessile, upper quite sessile;
base narrowed into the petiole;	base of lower leaves narrowed into the short petiole, base of upper leaves increasingly rounded up to quite cordate.
base of leaves with one or two glands on each side. *Note.*—It has been assumed that these glands are metamorphosed stipules, but they are marginal on the leaf base, and often more than one. They seem more probably to represent a glandular development of the basal, and sometimes also the suprabasal, serrature of the leaf margin.	base of leaves always e-glandular.
serratures of leaf-margin very shortly subulate.	serrature more longly subulate. *Note.*—This is a rather uncertain characteristic.
Pedicels quite glabrous.	Pedicels with two distinct lines of pubescence.
Flowers :—	Flowers :—
dorsal petal slightly puberulous;	dorsal petal markedly pubescent;
corolla uniform pink or white, only slightly marked with darker colour.	corolla pink with a conspicuous darker line down the inner edge of each of the lip-petals.
	Ripe capsule not seen; immature capsule as in *kleinii*, but longer.
	Seeds as in *kleinii*.

There seems little doubt after a careful examination of many fresh specimens that we have here two distinct species. Balsams being often endemic in small areas, it is possible that the new species is not widely distributed. On the other hand, since Hooker (followed by other botanists) says that the glands at the base of the leaves of *I. kleinii* are sometimes absent, there seems reason to believe that the two species are mixed up in herbaria. The new species can be distinguished at once by the lines of pubescence on the pedicels, the sessile upper leaves with cordate base, and the absence of glands.

It is proposed to name and describe the new species in a later issue along with some other new species in other families.

SOME NOTES ON GAME BIRDS IN MESOPOTAMIA.

BY

Capt. C. M. Thornhill, 24th Punjabis.

1916.

Right Bank Tigris was not visited. These notes were compiled on the Left Bank between Wadi and Sannaiyat. Country open level plain, a little grass in places and a few scrubby bushes up to 3 foot high. The Wadi, an open stream, about 20 to 50 yards high with banks 5 to 15 foot high, no vegetation.

Suweikieh marsh.—A marsh that is about 30 miles long, maximum width 10 (winter when full of water) with only 5 small clumps of reeds, each about 30 yards long by 10 wide. A strong wind shifts the marsh 1 to 2 miles in a few hours.

1917.

The country traversed was the Left Bank Tigris from Sannaiyat to Bawi and the right bank from Bawi to Samarra.

[*N.B.*—When year is not mentioned, the reference is to 1916.]

1. Imperial Sand-Grouse—*Pterocles arenarius.*

Small flocks seen and a few birds shot between November 1st and March 10th.

2. Large Pin-tailed Sand-Grouse—*Pteroclurus alchata.*

Very common and in enormous flights. Partial migration in October and the end of March. Nesting in large numbers in May and June. All my eggs were broken. I have frequently seen this bird pitch on water to drink.

3. Spotted Sand-Grouse—*Pteroclurus senegallus.*

Not rare. One or two shot every time we were out after Sand-grouse. Apparently bred in May as I frequently saw the birds, but never found the nest. The birds were present all through the hot weather.

4. Common or Grey Quail—*Coturnix communis.*

Very plentiful in April 1916, but this year (1917) there was no corn and only a few seen about the end of March and in April. No other kinds were seen.

5. Seesee—*Ammoperdix bonhami.*

A few at Harbe and Istabulat on the Old Canal Banks, fairly plentiful in the broken ground and ruins above Samarra, nest with 8 eggs found May 24th, 1917, about 5 miles beyond Samarra.

6. Black Partridge.—*Francolinus vulgaris.*

Plentiful wherever there is cover. In many places they literally swarm. The call is shriller than that of the Black in India and has an extra syllable thrown in. Several people have spoken of grey partridges but where I was able to see the so called greys they were either hens or immature blacks.

[Several correspondents have remarked on the difference of the call of the Black Partridges in India and Mesopotamia. In this connection it is interesting to draw attention to some remarks by Dr. Hartert of the Zoological Museum, Tring, on *Francolinus francolinus* (=*Francolinus vulgaris* of the Fauna) in the last number of Novitates Zoological, Vol. XXIV, pp. 288-290). From these notes it would appear that the Black Partridge inhabiting Sind, Baluchistan, South Eastern and Southern Persia to Fao and Bagdad belongs to a different race to that found in North-Western India. The former is called *F. francolinus henrici* and is a much paler bird than the latter, which Dr. Hartert says should go by the name of *F. f. asiæ*. The Black Partridge ranging from "easternmost Nepal to Assam, Manipur, Dacca, Maunbhoom" differs in the barring of the rump besides other peculiarities, which were noticed by Hume in 1899 (*vide* Stray Feathers, XI, p. 305). This race is called *F. f. melanonotus.*—EDS.]

7. Common Crane—*Grus communis.*

Seen in fair numbers on Suweikich Marsh.

8. Demoiselle Crane—*Anthropoides virgo.*

Seen in fair numbers on Suweikieh Marsh.

9. Great Bustard—*Otis tarda.*

Seven seen just S. of the Wadi in the first week of March, but was unable to get within 500 yards of them and could not say whether they were European or Indian.*

10. Little Bustard or Butterfly Houbara—*Otis tetrax.*

Four seen about 3 miles S.-E. of the Wadi during the 3rd week of March.

11. Houbara—*Houbara macqueeni.*

Fairly plentiful. Seemed to leave Hanna district early in April and return in early August.

They remained round Samarra throughout the hot weather, 1917, and were breeding there.

12. Woodcock—*Scolopax rusticula.*

One flew into a camp on the bend of the river one mile below Falahiyeh at dusk on the 6th October. The camp was in Tamarisk scrub about 2½ to 3 foot high. No one had a gun to shoot it with.

One crossed the river at dawn on 11th November about 300 yards upstream of the camp. It flew straight over my bed not 15 yards from me, and pitched in some scrub about a mile away. To get to the spot one had to go round by the bridge, a total distance of 3 miles, and though I went off at once we could not find the bird.

13. Solitary or Great Snipe—*Gallinago major.*

A small patch of flooded wheat and coarse grass near Harbe in April 1917 seemed to be full of these birds.

I came on the patch after sunset on the 10th April, and shot one Common and one Solitary Snipe and missed several others. On the 11th two of us shot two, lost two more in the thick grass and missed two others. There were more than ten birds, all Solitary Snipe as far as one could see, but there being no other cover they at once made off and circled high and disappeared in a Northern direction.

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* The Great Indian Bustard *E. edwardsi* is not found outside India.—EDS.

On the 12th (General Peebles, Capt. Haughton and I). Two guns got five lost two in addition to the five bagged and missed five; we calculated there were fifteen birds there. Owing to operations we did not get another chance of trying the place.

The following are the measurements of the 8 birds bagged:—

	Bill.	Total length.	Wing spread.
April 10th ..	$1\frac{15}{16}$ in.	$10\frac{1}{4}$ in.	8 in.
,, 11th ..	$2\frac{1}{4}$,,	$11\frac{1}{2}$,,	$8\frac{1}{2}$,,
	$2\frac{1}{8}$,,	$12\frac{1}{16}$,,	9 ,,
,, 12th ..	$2\frac{1}{4}$,,	$12\frac{1}{4}$,,	$9\frac{1}{16}$,,
	$2\frac{1}{4}$,,	$11\frac{1}{2}$,,	$8\frac{1}{4}$,,
	$2\frac{1}{4}$,,	$11\frac{3}{4}$,,	9 ,,
	$2\frac{1}{8}$,,	$10\frac{5}{8}$,,	8 ,,
	$2\frac{1}{16}$,,	$10\frac{1}{2}$,,	$8\frac{1}{2}$,,

The above measurements were made by putting pins into a board on which the bird was laid and then measuring the distance between the pins with a protractor. The first bird of the 12th was an enormous one and I got him weighed at a hospital and though the accuracy of the weight is open to doubt, it was just a shade over 11 oz. The other snipe were not weighed on scales, but were roughly weighed against Common Snipe and=3 Common Snipe.

The Solitary Snipe were in good condition and the Common Snipe were skeletons almost.

14. Common or Fantail Snipe—*Gallinago cælestis.*

Common and plentiful wherever there is suitable ground. Seen up till May 8th. First wisps coming in seen and shot on August 19th.

15. Jack Snipe—*Gallinago gallinula.*

Saw and shot one at Wadi, March 11th and one at Harbe, April 11th, 1917.

16. Painted Snipe—*Rostratula capensis.*

Not seen though I heard of one being shot near Wadi, but the bird had been cooked and eaten and I was unable to see any feathers.

17. Swan.

Variety unknown, thirteen seen flying over the Suweikieh Marsh, 22nd and 23rd of January.

18. Grey Lag Goose—*Anser ferus.*

Large numbers in winter. I fancy these geese breed in the large marshes in small numbers, though the majority appear to migrate. Seen at Sannaiyat up to 8th May. Thirteen birds seen on Suweikeih Marsh at Hanna, 7th July, got to within 100 yards of them with L. J. Macdonald, all birds seemed through glasses the same size and old ones.

Saw a few in the thick reed marshes about Ezra's Tomb on the 3rd and 4th July 1917.

19. Dwarf Goose—*Anser erythropus.*

Saw five on the Wadi, 20th-21st March; tried hard to get a shot, but they were very shy. On the 21st we tried to drive them but unfortunately though they flew over my companion he missed them. Am pretty sure of their identity as I watched them through glasses at 80 yards and have shot them in India.

20. A Black Goose—(?) *Branta ruficollis.*

Unable to identify or shoot. A flock of eleven were about Hanna from March 11 to March 17, and were usually accompanied by five or six Grey Lag.

[The Black Goose is probably *Branta ruficollis,* the Red-breasted Goose, a species found in Siberia and migrating to the Caspian, Turkestan and Egypt. Several correspondents have mentioned this species.—Eds.]

21. Common Sheldrake—*Tadorna cornuta.*

A fair number seen. One shot out of flock of seven at Hanna, 17th March 1916. One shot at Falahyek, 26th Sept. One pair seen at Hanna, 1st July 1917.

22. Ruddy Sheldrake or Brahminy Duck—*Casarca rutila.*

Fairly common. Breeding about Istabulat and Samarra, April-May 1917. One clutch of 8 eggs found in a hole in the low hills, N.-W. of Samarra (Right Bank Tigris), 14th May 1917. Eggs fresh. The hole looked like an old jackal hole. Eggs were about 14 feet below the surface and about 20 feet in. Saw many pairs that were nesting.

23. Mallard—*Anas boscas.*

Common, probably breeds in marshes as I saw them in every month. A few only in June-July.

24. Bronze-capped Teal—*Eunetta falcata.*

A drake in full plumage shot out of a small flock of Gadwall on 19th March at Hanna.

25. Gadwall—*Chaulelasmus streperus.*

Common. Saw none in hot weather.

26. Common Teal—*Nettium crecca.*

Common. Seen up till May 8th and again from 2nd August onwards.

27. Wigeon—*Mareca penelope.*

Very plentiful in winter, 1915-1916, and a fair number about in winter, 1916-1917.

28. Pintail—*Dafila acuta.*

Fairly plentiful.

29. Garganey Teal—*Querquedula circia.*

None seen in 1916. A single bird seen and shot March 4th, 1917.

Several flocks seen and some birds shot April 10th, 11th and 12th, 1917, at Harbe.

30. Shoveller—*Spatula clypeata.*

Common, not seen later than May 8th or before August 29th.

31. Marbled Duck—*Marmaronetta angustirostris.*

None were seen till April 10th, when they appeared about Hanna and Sannaiyat, several flocks up to twenty in number. They soon split up and bred nesting on the grass and scrub on the river bank. I got no eggs but one pair nested in "No man's land" at Sannaiyat, one pair on the river bank at Falahiyeh and one at Hanna, the two latter nests I found, one had 5 hard set eggs, the other 6 on the 15th and 18th of May. The nest was made in a tamarisk bush in one case and in a large tussock of grass in the other.

The birds were about till September 20th, when they disappeared. A fair number of young seen and caught in June. Twelve were seen at Harbe, April 10th, 11th, 12th, 1917. One pair regularly seen in May and June 1917, 5 miles above Samarra.

32. Red-crested Pochard—*Netta rufina.*

A few seen and shot.

33. Pochard or Dun-bird—*Nyroca ferina.*

Common.

34. White-eyed Pochard—*Nyroca ferruginea.*

Common.

35. Tufted Duck—*Nyroca fuligula.*

A few seen and shot.

36. Golden-eye or Garrot—*Clangula glaucion.*

Single bird drake, shot at Hanna, 20th March. Two ducks shot out of a flock of 10 or 12 birds flighting at dawn on the Tigris at Hanna, 5th September. A pair of birds seen and shot on the River at Hanna, 25th September.

37. Stiff-tail Duck—*Erismatura leucocephala.*

Single bird came down the river in an exhausted state and was shot from the Falahiyeh Sandy Ridge Bridge, February 6th, 1917. The bird was a drake in nearly full plumage.

38. Smew—*Mergus albellus.*

A pair seen and shot on the Tigris at Falahiyeh, 5th September.

MISCELLANEOUS NOTES.

No. I.—A FIGHT BETWEEN A DOG AND A PORCUPINE.

I am sending you an account of the curious result of an encounter between a dog and a porcupine. The other morning my servants told me that there had been a fight on the road between a dog and a porcupine, that the porcupine had driven a quill into the dog's skull, and that the dog maddened with pain had run into my compound and plunged into an open garden reservoir and died there. True enough I saw a large dog with a porcupine's quill firmly imbedded in the skull just above the eye. The evidence of there having been a fight on the road was the sweeper's statement that he had seen a number of quills lying on the road, but these had been removed before I could see them. However much the servants may have drawn on their imagination it seems clear that the dog was killed by the porcupine and it would be interesting if any of your readers could enlighten me as to the porcupine's mode of attack.

R. D. MACLEOD, I.C.S.

MUTTRA, 1*st August* 1917.

No. II.—BUFFALO IN THE NICOBAR ISLANDS.

In that interesting and informing book, Ball's Jungle Life in India, mention is made of the buffalo which were found by the author in a wild state on the Island of Kamorta in 1869.

These buffalo are supposed to be descended from tame animals imported during the earliest European occupation of the Island, that by the Jesuit Missionaries, about the year 1711.

Two or three years ago an officer of my acquaintance saw buffalo on this Island and endeavoured to get a shot at one, but failed owing to want of knowledge of the locality and the short stay, a few hours only, of the steamer.

It would be very interesting if some visitor to the Island could obtain heads ot a bull and a cow for the Society collection. Probably the horns will exceed in measurement those of the Indian wild buffalo of the present day as the animals can have been but seldom molested, and, having run wild for close on 200 years, have probably reverted to type, the original wild stock.

R. W. BURTON, LT.-COL.

BOMBAY, *August* 1917.

No. III.—NOTES FROM THE ORIENTAL SPORTING MAGAZINE, NEW SERIES, 1869 TO 1879.

A perusal of the Oriental Sporting Magazine for the ten years 1869 to 1879 furnishes material for notes on various subjects, and these are here collected as being likely to interest some of the readers of our Journal.

WEIGHTS AND MEASUREMENTS OF ANIMALS.

TIGERS: Deccan Ranger (Colonel H. Fraser), who shot for many years in the Hyderabad Dominions, came to the same conclusion as the present writer as to the measurement being an insufficient guide to size; and, during the last few years of his shooting days, weighed all tigers killed by him.

It would be of general interest if sportsmen would weigh animals they shoot. A Salter's circular spring balance to weigh 300 lbs. will give sufficiently accurate results as, with due care, an animal can be weighed in two or three pieces with but little loss of blood and consequent guess work.

Perhaps an Engineer member of the Society can suggest a simple weighing balance to weigh up to say 2,000 lbs.; such as that used by Mr. Roosevelt during his African expedition?

Here are Deccan Rangers' records—

Tiger	10′ 1″	425 lbs.	Tigress	9′	330 lbs.
,,	9′ 10″	432½ ,,	,,	9′	282 ,,
,,	9′ 10″	425 ,,	,,	8′ 11″	284 ,,
,,	9′ 6″	447½ ,,	,,	8′ 11″	245 ,,
,,	9′ 6″	420 ,,	,,	8′ 9½″	281 ,,
,,	9′ 6″	370 ,,	,,	8′ 8″	270 ,,
,,	9′ 4″	400 ,,	,,	8′ 8″	285 ,,
,,	9′ 4″	368 ,,	,,	8′ 6″	250 ,,
,,	9′ 2″	330 ,,	,,	8′ 5½″	240 ,,
			,,	8′ 5″	256 ,,
			,,	8′ 5″	253 ,,

Average; Tigers: 402 lbs., tigresses: 270 lbs. All these animals were shot in the Hyderabad country, and those obviously not full grown are excluded. Col. Fraser records that a friend (Col. Baigree), who had shot over 200 tigers, said that the 432½ lb. beast was the largest—excepting one, that he had ever seen.

In 1872 (Vol. V, p. 73), the late Sir Montagu Gerard contributed measurements of some tigers shot by him in Central India.

His last expedition, which was in 1898, in the Northern part of the Hyderabad country, brought his personal bag of tigers to 227.

His 1872 records are as follows:—

Average of 15 tigers, 8′ 11″
,, of 20 tigresses, 8′ 1½″

Measurements taken from point of nose to tip of tail, the tape loosely following the curves of the body.

Other writers to the Magazine record measurements of tigers, but there is nothing to indicate that these are reliable, or how they were taken, so they are not mentioned here.

In "Shooting in Cooch Behar" the Maharajah records that the *largest* tiger—tail included—that he ever saw or shot was 10′ 5″, this animal weighing 504 lbs. The *heaviest* tiger actually weighed 546 lbs. "fully gorged" and amongst the records given are 7 tigers which weighed 500 lbs. or more. From this it is evident that the tigers of Bengal attain larger dimensions than those of Central India and Hyderabad. At page 144 of Vol. XXIII of our Journal, the measurements of a Central India tiger are given as 11′ 6″, the body being 8′ 2″ and tail 3′ 4″. It is a pity this animal was not weighed.

Various Notes as to Tigers.

Colonel Fraser records it as the result of his experience, his conclusion being finally arrived at owing to an instance which he relates (Vol. VIII, 1875, p. 101) that "there is no doubt now in my mind that a male tiger does provide for his offspring in the absence, from causes unknown to him, of the mother." This is a valuable note as it is made by a sportsman of great experience who is also a careful writer.

There are several contributions regarding tigers feeding on carcases of animals not killed by themselves, and of them feeding on carrion.

It is, of course, a well-known fact that tigers invariably commence feeding at the hind quarters of a kill. That panthers as invariably begin their feed at the forequarters is a popular belief, repeated in a recent work on the Game Animals of India (R. Lydekker, 1907). In the writer's experience it is the exception for a panther to commence feeding at the forequarters of an animal and doubtless most sportsmen will concur that this is so.

Contributors to the Oriental Sporting Magazine, when they mention the matter, express conflicting opinions.

Poisoning Tigers.

The Bhowany Taluq of the Coimbatore District in the Madras Presidency was a tiger slayers paradise in 1873. Tigers were so numerous that poisoning was resorted to, these operations resulting in recovery of 13 poisoned tigers, while 24 vomitting beasts crept away to die or recover according to their fate. Also 14 tigers were shot by shikaris, and 2 were trapped.

Another method of slaying tigers was ventilated by a contributor and received the approval of the Editor of the day. It is what might be topically described as very "Home-like" the present day sportsman's ideas on such matters. An instance is recorded in 1871 of a tigress climbing a tree in the Neilghery hills. The tree trunk was a foot in diameter and perpendicular and branchless to a height of 25 feet. The beast climbed up, and lay along a branch some six feet above the lowest bough. Such a performance is very exceptional, but makes one feel quite unsafe at the usual 10 or 12 feet!

In the Days of the Emperor Akbar.

"Young Nimrod", a sportsman of experience disguised under this nom-de-plume, contributed a series of very interesting articles on the methods of shikar as pursued in the time of the Emperor Akbar and recorded in the "Ain-i-Akbari." Space and time do not permit of lengthy extracts. That some of the methods were cruel is illustrated by the recommendation that the tethered goat should have red pepper put in the eyes to ensure sufficient bleating! The device of strewing hay smeared with "glue" on the ground around the tethered bait so that the tiger gets his claws, paws and face covered with sticky grass which also gets into his eyes, is ingenious. History does not relate that it is practical! The presumption is that the tiger is found rolling about helpless in the near vicinity of the "kill" or tethered bait.

R. W. BURTON, Lt.-Col.,
Indian Army.

Bombay, *3rd October* 1917.

No. IV.—FURTHER NOTES ON BIRDS NESTING IN THE TONS VALLEY.

Accounts of two birds nesting trips to the Harke Dun, near the source of the Tons river, undertaken in June 1896 and 1897 are given at pages 64-72 and 468-473 of Vol. XI of this Journal.

In June 1917, I again visited the same locality and wish to add a few notes supplementary to those previously recorded.

Lophophanes dichrous (The Brown Crested Tit).—On arriving in the hills on April 30 at Deoban, elevation 9,000, about 4 miles from Chakrata, I noticed the Brown Crested Tit fairly common in the Kharsu oak forest. A little patient watching and I was rewarded by seeing one of these birds disappear into a circular hole in a rotten oak branch, about 20 feet from the ground, which proved to contain the nest.

The hole, which had evidently been excavated by the parent birds, lead to a small cavity about 5 inches deep in which was placed the nest, which was composed of moss copiously lined with grey hair. There were 5 fresh eggs, white spotted all over but mainly at the large end, with red brown.

They measured about 0·69″ by 0·50″. So far as I am aware the only previous record of the taking of this bird's eggs is in a note of mine at page 542 of Vol. XIII of this Journal.

Falco subbuteo (The Hobby).—On May 16th, at Konain, elevation 7,800 feet, my attention was drawn by a lot of squealing to two little falcons engaged in driving off a Jungle crow. The falcon's nest was placed near the top of a large deodar tree, some 100 feet from the ground.

I examined the birds carefully with my glasses and they were unmistakeably the European Hobby.

The nest was unfortunately empty, and 10 days later it was still in the same condition. This is, I believe, the first record of the nesting of the Hobby within Indian limits.*

Ægithaliscus niveigularis (The White-throated Tit).—The white-throated tit is not very rare in the wooded areas just below the snows.

On June 11th in rather open mixed broad leafed forest of cherry, birch, &c., I noticed one of these birds carrying food in his bill.

It was not long before he gave away the position of his nest, which was placed in the fork of a cherry tree, 10 feet from the ground.

The nest exactly resembled that of the English long-tailed Tit. It harmonized so closely with its surroundings (lichen-covered bark) that it would probably have escaped my notice had its position not been betrayed by the parent bird.

The nest was copiously lined with feathers, mainly those of the Monal pleasants. It contained half fledged young.

The nidification of this bird has not been previously recorded.

Siva strigula (The Stripe-throated Siva)—A nest of this bird found at 9,500 feet in a dense thicket of dwarf willow was placed at a height of about 7 feet from the ground.

It was composed of dry grass, bamboo and other dry leaves, held together with a little lichen (*Usnea barbata*) and was lined with fine black roots and the dry (brown) needles of the Blue Pine.

It contained three slightly set eggs, hedge sparrow blue with black spots perfect little miniatures of those of the English song thrush. These agree exactly with those described by me at page 469 of Vol. XI of this Journal, and one cannot help suspecting that the eggs found by Hodgson and described in the F. B. I. as being " pale bluish speckled with red " must have belonged to some other species.

Chelidorhynx hypoxanthum (The Yellow-bellied Flycatcher).—The Yellow bellied fantail is common in the valley between 10,000 and 11,500 feet, in the zone of the birch and of the high level silver fir (*Abies webbiana*).

In the cold weather it descends to the lower valleys and even to the sub-Himalayan tract, but so far as my experience goes, it is absolutely confined to the big level forests in the breeding season, pace R. Thompson's statement to the effect that it breeds in the Kumaon Bhabar.

I found three nests, at about 10,500 feet elevation, two in birch trees, about 20 feet from the ground and one in a silver fir, 12 feet up. The nests are beautiful little cups with nearly vertical sides measuring 2″ in height by 2½″ external and 1½″ internal diameter. They are composed of fine moss decorated on the exterior with bits of a foliaceous lichen, and are lined with red moss fruits.

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* The Central—Asian Hobby has been recorded as breeding in Kashmir, Kurran and Khagan Valleys, Murree Hills, the Galis and Simla.—Eds.

On June 16th two nests contained three fresh eggs each and the third was empty and nearly ready for eggs.

The eggs are very delicate, pinkish white with a faint cap of purplish grey at the big end.

The nests are usually placed on branches at least as thick as the diameter of the nest and they are very difficult to spot.

Grandala cœlicolor (Hodgson's Grandala).—These beautiful birds were observed on June 10th feeding close to the melting snow in a small colony at about 13,000 feet.

They were in pairs, but I failed to discover a nest and fancy they had not begun to breed.

Chelidon nepalensis (Hodgson's Martin).—Several small colonies of Hodgson's Martin were found breeding under overhanging rocks on vertical precipices at about 13,500 feet.

With the aid of a long pole carried up 2 or 3 miles from the forests below we succeeded in reaching some 8 or 10 nests, but the birds were only just commencing to lay, so we only secured seven eggs.

The nests were exactly like those of the English House Martin, only smaller, and were lined with fine grass.

The eggs were, of course, pure white and measured from 0″·70 to 0″·77 in length and from 0″·48 to 0″·51 in breadth, the average being 0″·75 by 0″·50.

The breeding of this species at such high elevations has not, I believe, been reported previously.

B. B. OSMASTON, I.F.S.

DEHRA DUN, *October* 1917.

No. V.—BIRD'S NESTING IN THE BHILLUNG VALLEY, TEHRI GARHWAL.

Scolopax rusticola (The Woodcock).—On my way back to camp from shooting I flushed a bird at my feet and looking down found four eggs on the ground. I was near the top of a ridge some 11,000 feet high overlooking the Bhillung Valley. The nest was on the side of the hill under a single root of rhododendron, and was just a mere hollow lined with a few leaves. The surrounding ground was grass with patches of brush-wood like heather. I waited for the return of the bird which turned out to be a Woodcock. The eggs were large for the size of the bird and measured 1·81×1·4: 1·8×1·39: 1·75×1·4 and 1·76 × 1·4. They were in colour a buffish brown, with spots and blotches especially at the larger end of dark brown with underlying marks of purple. They were within about three days of hatching. Birds that I took to be Woodcock used to fly round the camp like flying foxes every night making a most extraordinary buzzing noise. I tried in vain to shoot them but they always appeared when I was not ready Their long beaks showed out clearly in Silhouatte in the evening sky.

Merula albicincta (The White-collared Ouzel).—I found two nests of this birds on the same day, June 6th, at an altitude of 10,500 feet. Both nests were made of moss and roots and lined with grass and were situated in the fork of a small tree about 4½ feet from the ground. The first nest contained four fresh eggs (1·25×91 : 1·25×9: 1·24×9 : 1·24 × 1·89) and were exactly like those of the English Blackbird, a bluish green background with brownish spots and blotches especially at the larger end. The second nest contained one egg just hatching and one newly hatched young. The birds were very shy in both cases and flew off with a loud noise.

This bird was very common about this part and must have been breeding in fair numbers.

Merula castanea (The Grey-headed Ouzel).—A nest of this bird was found on June 14th at 10,500 feet made of moss and roots, and situated on the trunk of a fallen tree covered with underground. It contained 3 fresh eggs in colour of a greenish blue ground profusely speckled all over with brownish spots and freckles. In shape they were very long and narrow measured 1·36 × ·89 : 1·37 × ·89 : 1·36 × ·88.

Myiophoneus temmincki (The Himalayan Whistling-Thrush).—I found this bird's nest with three fresh eggs on June 18th at about 10,000 feet.

Oreocincla mollissima (The Plain-backed Mountain-Thrush).—I found one nest of this bird on June 14th situated in a low fork almost on the ground on the side of a hill. The nest was made of moss lined with roots and fine grass.

It contained four fresh eggs (1·41×·96 : 1·4×93 : 1·4 × ·92 : 81 ·39 ×·95) very handsomely marked the ground is whitish and especially at the larger end the eggs were profusely blotched and spotted with chestnut and reddish brown, and in some cases almost blood red. The bird was a close sitter and when disturbed hung about close by in a great state of agitation.

Oreocincla dauma (Small-billed Mountain-Thrush).—I found two nests of this bird. The first on June 12th at 10,000 feet was situated in a low fork on a grassy bank made chiefly of moss and dry grass and lined with grass, and roots and contained two eggs just hatching and one newly hatched young. The second nest found on June 14th was built among large stones covered with moss and undergrowth on the side of a hill. The nest was similiar to the first and contained three fresh eggs in colour of a whitish background profusely speckled all over with small red brown specks. They measured 1·25 × ·92 : 1·27 × ·9 : 1·28 ×·91. The birds sat very close.

Horornis fortipes (The Strong-footed Bush-Warbler).—A nest of this bird was found on June 17th at about 9,500 feet. It was built of coarse grass and loosely put together so that it looked almost domed. It was profusely lined with feathers, and situated at 3 feet from the ground in a bramble at the foot of a bank. It contained four eggs of the most striking colour I have ever seen. A uniform deep chocolate tinged with purple. They measured 0·70 × 0·51 : 0·71 × 0·53 : 0·72 × 0·82 : 0·72 × 0·51.

Pnoepyga squamata (The Scaly-breasted Wren).—On June 6th, I came across a nest of this bird at about 10,500 feet. The nest was built almost entirely of moss and was situated under an overhanging moss clad rock on the side of a ravine. It was domed with a hole at the side and contained three fresh eggs, pure white with the exception of two or three reddish brown specks on two of the eggs. They seemed very large for the size of the bird and measured 0·8×0·61 and 0·79×·06. Unfortunately the third egg got broken before I measured it. The bird sat very close and I almost caught it in the nest.

Phylloscopus proregulus (Pallas's Willow-Warbler).—On the 8th June, I moved camp and after marching some 6 miles, I sat down under a tree. My attention was soon attracted by two tiny birds which I took to be Goldcrests at first, making a great twittering and seemingly greatly agitated. Thinking there was probably a nest somewhere near I retired about 15 yards in cover where I could watch the tree. After some minutes the twittering suddenly ceased and the birds seemed to disappear. I approached the tree and gently shook the branch on which I had last seen the bird and to my amazement a bird flew out of the moss covered bough. I examined the branch carefully and eventually found a minute hole in the moss into which I carefully inserted my finger. I was delighted to feel 4 eggs. This was, I think, the most wonderfully concealed nest I have ever seen.

The branch on which it was built was itself thickly covered with moss and the nest was half suspended and closely built into the branch. It was made entirely of moss and profusely lined with feathers. The entrance hole at the top on one side was only about an inch across. When examining the bough at about 1 foot, I was unable to find the nest except by feeling with my fingers. The bird turned out to be *Phylloscopus proregulus* and the eggs half incubated were white with reddish brown spots chiefly at the larger end. One unfortunately broke when being blown. The other measured 0·57×0·45 : 0·6×0·48 : 0·58×0·46.

The nest was on the outside of the tree (moss covered oak) and about 7 feet from the ground.

Another nest of this bird found on June 17th contained four fully and fledged young. The nest was about 18 feet from the ground suspended from the outside branch of a fine tree and made entirely of moss.

Ianthia rufilata (The Red-flanked Bush-Robin).—A nest of this bird was found on June 15th at about 10,000 ft. The nest was in a hole in a bank about 4 ins. in and about 4 ft. from the ground. It was very well concealed and made of fine grass and lined profusely with the hair of the musk deer. It contained 3 fresh eggs of a whitish colour very faintly and sparingly spotted at the larger end with pale reddish brown. They measured 0·72×0·57 : 0·73×0·57 and 0·74×0·53. The birds kept in the neighbourhood when the nest was being robbed and showed great agitation.

Accipiter virgatus (The Besra Sparrow-Hawk).—On May 9th near Bhim Tal, I found the nest of this bird in a tree about 20 feet from the ground in a fork, overlooking a khud. The nest, made of sticks of various dimensions and about 18 inches across contained 2 fresh eggs, of a white ground colour blotched and spotted with blood-red and brown, one at the larger end, and one at the smaller. These I took. Three days later the nest contained another egg, white with a sort of pale brown smear over one side. The first 2 eggs measured 1·65 × 1·35 : 1·57 × 1·32 and the third one 1·75 × 1·3.

The birds showed the utmost concern when the nest was being robbed and flew and swooped at me again and again compelling me to ward them off with my hand. At intervals they would settle about 3 or 4 yards away screaming the whole time and then would attack with renewed vigour.

U. S. Club, Lucknow, W. H. MATTHEWS.
July, 1917.

No. VI.—THE OCCURRENCE OF THE INDIAN PITTA (*PITTA BRACHYURA*) IN THE KANGRA DISTRICT, PUNJAB.

In the Fauna of Br. India, Vol. II, page 394, the range of *P. brachyura* is given as:—"The whole of India from Eastern Rajputana and Garhwal to Sikkhim, and Calcutta, extending South to Cape Comorin and Ceylon" so its occurrence in the only Province from which it is excluded, will be of interest. I first saw a single bird flying across the road on June 15th, and on the 25th of the same month, while motoring past, I noticed a bird leave a tree. I stopped the motor and waited and in a few minutes, it, or the pair, returned to the same tree. I got off and took my lunch to the foot of the tree and waited further developments and soon discovered the nest. It was some 30ft. from the ground, in the fork of a large "Bird-cherry." A large nest made of long strands of coarse grass and straw and lined with the leaves of the "pipul" tree, which must have been green when they were brought to the nest. Inside were 5 youngsters which could not have been more than a day old, as they did not show a single quill between the lot of them, except a faint trace of the wing quills.

I brought away two in the hope of rearing them. One died very shortly after but the other, though backward to start with, flourished, and I had every hope of succeeding with him when an accidental fall from the hand proved too much for him and he died a couple of days later.

Since the young of this family are supposed to resemble the adults in plumage, except that the colouring is not so vivid, it will perhaps be of interest to some of our members, to give the progress and development of the little one I had, and show how very far the first plumage is removed from that of the adult.

A.—Before any quills appeared on the scene; on 26th June 1917. Head, neck, upper parts of back and wings and breast, a shiny lead black, like polished india-rubber. Lighter on abdomen, the latter very distended. Legs, a dirty salmon pink. Beak, black on top with the edges of both mandibles orange yellow, darker at the tip and lighter at the gape. Lower mandible slightly longer than the upper.

June 28th.—Very little if any difference.

July 1st.—One died. The second growing; wing quills more apparent and various feather tracts becoming visible.

July 3rd.—Eyes opened. Wing quills about ½" long and those on the back and tail becoming conspicuous. Quills very similar in colour to the skin though somewhat lighter.

July 6th.—Wing quills developing very fast and becoming extraordinarily long being nearly ¾ as long as the body. The quills on the head and body also very long when compared with other birds in a similar stage. The quills on either side of the abdomen and round vent assuming a faint tinge of pink.

July 8th.—Feathers just apparent and bursting through two of the primary quills. The tips of secondary quills very light coloured, almost white, but no feathers showing.

July 10th.—Feathers have broken through all the wing quills. The tips much lighter than the rest which is a very deep green, almost black with a green sheen, tips whitish. A few pink feathers showing round the abdomen and dark grey or brown tips showing through the quills on breast.

July 12th.—Most of the feathers come through on the wings, including the coverts. Breast feathers and scapulars also through. Quills on head about ½" long but no sign of feathers. Eating ravenously and recognises voices. Sits up in his nest as soon as he hears anyone talking with wide open mouth. Quite a loud, though pleasant, single note whistle. Sits up on his long tarsi but cannot stand.

July 13th.—Fell out of his nest and later on out of the bearer's hand on to the floor. Am afraid he is hurt.

July 15th.—Not eating well in the morning. Found him in his nest in the evening very limp and icy cold, with all his food coming out of his mouth. Gave a few drops of brandy, wrapped him up in cotton wool and put him between two hot-water bottles. Revived considerably by midnight, and wanted food.

July 16th.—Very sorry for himself and completely off his food. Died by the evening.

Description as on 16th.

Feathers come through the quills everywhere except a few on the head and tail.

B.—Colouration.—

Head dark grey, each feather with a blackish tip.

A black stripe from below the eye to the nape. Ear coverts black. Chin white, neck and breast grey-brown the centre of the feathers faintly marked with vinous.

Lower breast and sides grey. Abdomen pink.

Scapulars grey, faintly tinged with deep green.

Lesser wing coverts black faintly tipped with grey.

Median coverts black at base, deep green for the last third of length, narrowly tipped white.

Greater coverts similar to the median coverts, but colours more pronounced.

Winglet black.

Primaries black fading to grey near the tips, where the outer web is narrowly margined with white.

Secondaries black near shaft, both wings tinged with a dull greenish blue. Tip of each feather white.

Tertials similar to secondaries but no white on them.

Tail—no feathers visible.

Legs and feet almost orange now, the upper portion of the tibia covered with grey feathers.

Except for the very faint tinge of blue on the secondaries which is hardly discernible except in good light, there is no blue about the youngster and the whole is as unlike the adult as one could make it.

The nest was found in the Kangra District at an altitude of about 3,000 feet above sea level, between Nurpur and Kotla, and this point must be about 100 miles as the crow flies, to the nearest portion of its recorded range, with a succession of high ranges in between.

I have never seen this bird in the Simla District, a portion of which adjoins the U. P. but is still a long way from the nearest limit of Garhwal, and it seems strange that a pair should skip so many miles of country and find their way up here.

DHARMSALA, KANGRA DISTRICT,
24th July 1917.

C. H. DONALD, F.Z.S.

No. VII.—ARRIVAL OF DUCK AND TEAL IN THE DARBHANGA DISTRICT, BEHAR.

The first duck seen was a female Red-crested Pochard (*Netta rufina*) which was got on the 22nd of last month; since then I have seen about half a dozen teal, but they can hardly be said to be in yet. There is no water, at least in this part of the district, except in the very big jheels, and if the smaller ones are not filled up a bit before the end of the monsoon, shooting is likely to be very local.

BAGHOWNIE FLY, LAHERIA SARAI,
2nd August 1917.

CHAS. M. INGLIS.

No. VIII.—NIDIFICATION OF THE LESSER OR COMMON WHISTLING TEAL (*DENDROCYCNA JAVANICA*) AND BONELLI'S EAGLE (*HIERAËTUS FASCIATUS*).

On the 12th August I took a nest of the Lesser Whistling-Teal, shooting the bird herself as she put up her head out of the nest hole in the mango tree. I found she was sitting on 10 eggs of her own, which were all a trifle incubated, and also two eggs of the Comb Duck, which were absolutely fresh. Possibly this lazy domestic habit of the Comb Duck is well known, but the only instance I can find in such books as I have is that Colonel Marshall found it laying in the nest of a White-necked Stork. Possibly also this habit accounts for Anderson finding 40 eggs under one bird.

As regards the nesting of Bonelli's Eagle, it may be of some interest to say that what Dewar writes on page 10 of his recent Bird Calendar which presumably represents the latest information on the subject is rather misleading, for my experience in this district leads me to believe the eggs can be got without much difficulty, and without attacking high cliffs. In the second week of February 1916, I found a nest on a small tree, only about 12 feet up, in a shallow ravine running parallel with the Jumna and about a mile from it. As there were two nestlings in the nest with the parent, I returned to this ravine on the 9th January 1917, and about 600 yards further along the ravine I found " Mrs. Bonelli " sitting on two fresh eggs. The nest was about 20 feet up a banyan and on the edge of the tree. I shot the bird for purpose of identification. I then moved camp away from the Jumna, and on the 18th January again found a Bonelli sitting on two fresh eggs. This was about 30 feet up on a peepal tree, again at the edge of the tree. This nest was found about 1½ miles north of the Canal, which makes it between 5 and 6 miles from the Jumna, and its tree was just on the edge of a patch of dhak jungle, where it overlooked cultivation. Next day, the 19th, I found a third Bonelli, not far from the second nest, constructing its nest. I regret to say I shot the second bird also, in order that there might be no possible mistake in identification. Thus 3 nests were found within 11 days, none near cliffs.

S. G. DE C. IRELAND.

FATEHPUR, U.P., 16*th August* 1917.

No. IX.—EXTENSION OF HABITAT OF THE HAIR-CRESTED DRONGO (*CHIBIA HOTTENTOTTA*).

Mr. Fitzgerald of Baijnath Tea Estate, wrote and told me that a pair of birds, with 2 or 3 presumably young ones, had made their appearance in Baijnath, Kangra District, Punjab, and as he had never seen them before, in all the years he has been in the District, wondered if I could tell him what they were. I went down to Baijnath a few days later and we shot one to make certain and it proved to be *Chibia hottentotta.*

I have never seen this species in the Punjab before and Mr. Fitzgerald, who is a very old resident and a very keen observer, did not know it either.

There were some ordinary King Crows about at the time and the difference in size between the two genera was very perceptible.

The measurements are no criterion of the actual difference between them. When on the wing the *Chibia* looked at least 1½ times the size of the Black Drongo (*D. ater.*)

I see Oates records its furthest Northern range as "from Garhwal to the extreme East of Assam," so its appearance in the Kangra District is interesting and I think worth recording.

Our thanks are due to Mr. F. Fitzerald for the discovery.

C. H. DONALD.

EGERTON HALL, DHARMSALA CANTONMENT.
August 26th, 1917.

No. X.—SOME NOTES ON THE BURMESE PEAFOWL (*PAVO MUTICUS*) IN CAPTIVITY.

I was much interested in Mr. Stuart Baker's article on this bird in No. 1 of Vol. XXIV of this Journal and having had some of the birds since the end of 1908 I kept some notes. I am sending these in case they may prove interesting.

As regards getting the train, my birds start acquiring theirs in October and it is beautifully developed by February and they start dropping it in May.

I have noted the following as to the colouring of the soft parts in a male. From nostrils to above, below and behind the eye purplish blue, near the nostrils it is more of a pale prussian blue tinged with yellow ; below this purplish blue the colour is chrome yellow. During the breeding season the colours are greatly intensified, the yellow assuming an orange yellow colour, and that portion of the skin seems to expand during this period, and has a slight fold behind at base below the ear orifice. Also the whole plumage of the bird gets a brighter and more brilliant hue.

Nobody, except Finn in his Game Birds of India, seems to mention one difference between the cock and hen and that is that whereas in the cock the patch of scaly feathers in front of the eye (lores) is metallic green, in the hen it is reddish brown. I did not notice this myself till I made water colour studies of both birds. This would be an easy means of telling the sexes in the young. In my female, the feathers on the front and sides of the neck are more coppery than in the males.

Chick.—Sides of head and throat lemon yellow ; crown and a streak from occiput to near ear blackish brown ; occiput and rest of neck and breast brownish buff ; back of neck browner ; a dusky streak from nape to below coverts ; remainder of lower plumage pale lemon yellow ; back sepia brown ; down on wings rufous brown, feathers pale Indian red tinged with yellow and marked with black except at tip ; on the primaries the markings are lighter ; tail brown : sides of thighs pale rufous yellow. Bill creamy yellow, purer yellow above the nostrils and reddish in front of nail ; iris greyish brown ; legs and feet yellow reddish between the scutæ in front of tarsus ; claws pink and soles of feet yellower than rest.

On the twenty-third day after birth the crest was noticeable but one chick did not show any signs of it till nearly two months old. When a month old, they started getting feathers on the body. When two and a half months old they began getting the metallic feathers on the back and sides of neck.

I saw a fortnight old chick fly on to the roof of a small house in the garden and when a month and a half old they began showing off.

Mr. Baker does not note the scale-like appearance of the neck and breast feathers of the adult which is quite unlike the plumage of the Common Peacock (*P. cristatus*).

Breeding.—I got my birds, a pair, in November 1908, but they did not breed till 1910. Then only two eggs were laid ; the small number of eggs being presumably on account of the birds being young. The eggs were laid at the end of March in a little hollow in the ground and were not hidden in any way. One was broken, I believe by the cock bird. For some unaccountable reason they did not breed at all the following year. I may mention that this was the same with some Swamp Partridge (*Francolinus gularis*) which had also bred in 1910 and did so again in 1912.

In 1912 I saw the peafowl in copulation for the first time. The cock bird was strutting about showing off with upraised train after the manner of his kind, the hen being nowhere near him ; but this did not seem to affect him at all. The hen then came quietly near him and on seeing her, he gave a loud scream and with drooping train made a rush at her, holding her down by the head with his bill. After she left him, he began strutting about as before and showing off.

She started laying on the 5th March on the bare pucca floor in a corner of the house and laid on the 5th, 7th, 9th, 12th and 14th, making five eggs at close intervals which would have formed a clutch; three more were laid from the beginning to the 3rd April and one again on the 6th and three more eggs from the 22nd to the 25th of that month, or a total of eleven eggs in seven weeks forming three clutches. The chicks hatched out on the 26th day.

The cock was unfortunately by mistake killed by my sweeper on the 24th March and though through the kindness of Mr. D. Ezra of Calcutta I was able to purchase another one in April of the same year, I have not been successful in getting any more fertile eggs. I have kept a cock from the chicks hatched in April and it is now five and a quarter years old but no fertile eggs have been laid by the hen, so I am afraid she is too old.

Eggs.—Some of the eggs are only slightly and others very deeply pitted, a number having some circular swollen ridges at the thin end. The ground colour varies from pale cream to pale salmon buff and deep rich buff, some being freckled with a darker shade of the same colour, others with deeper or lighter purplish grey; one egg was deeply spotted with fine spots especially round the thick end forming a small zone, there being some large blotches of reddish brown at the other end; another was speckled all over with reddish brown, and another had no freckles at all, only a few brownish pink blotches scattered about the centre and small end. The average of a number of eggs measured was 3″×2·11″; the lengths running from 2·90″ to 3·19,″ the breadths from 2″ to 2·20″.

Habits.—The call of this bird, I make out as Āow awe, Āow awe, Āow awe. This is sometimes made whilst resting on his perch inside the house during the heat of the day and sometimes on the ground outside the house, whilst uttering it his head is well raised up. It is a much pleasanter note than that of the Common Peafowl and like that of the latter bird can be heard from a great distance. He does not appear to have any special time for calling as I have heard him from 6 a.m. right up after 6 p.m., generally at shortish intervals, the longest break being between 10-30 a.m. and 1 p.m. I have seen the cock bird running round and round his enclosure and calling Āow, Kaw, Kaw, Kaw, Kaw, I think this note is uttered when something has frightened him.

In showing off, which he does at all times except during the heat of the day, he gives his tail a shake and up goes his train; every now and again he shakes his tail, probably this is done when the train starts to droop and he steps about as if on hot bricks, sometimes with his back, and sometimes with his front to the hen. She appears to pay no attention whichever side is facing her. Should she come near him in front, he gives his quills a shiver and should she continue to remain in front of him this is repeated several times, probably to draw her attention. Whilst showing off, the head is kept down and the bill slightly open. I have heard him calling whilst displaying.

BAGHOWNIE FTY, LAHERIA SARAI, C. M. INGLIS.
August 1917.

No. XI.—OCCURRENCE OF THE PINK-HEADED DUCK (*RHODONESSA CARYOPHYLLACEA*) IN THE PUNJAB.

On the 29th September 1917 I was crossing the Keshopur Jheel in a punt where we put up three large duck which I did not recognise. I shot one. It was a large duck chocolate brown above and dark brown below with a very distinctive rose pink-head and a very distinct tinge of the same colour to the white lining of the wings. The Shikaris (who reside in the locality of this jheel and are very knowledgable folk) declared it to be a very rare bird. On getting home Messrs. Mitchell (P. W. D.), Salusbury, (I.C.S.) and myself looked the bird up in Blanford and Oates. It was undoubtedly the Pink-headed Duck (*Rhodonessa caryophyllacea*, Lath.)

A. H. MARSHALL,
(Indian Police).

GURDASPUR, PUNJAB,
4*th October* 1917.

[In Vol. XXIV, page 599 of the Journal, Mr. H. Whistler recorded seeing two of these ducks in the Ambala District in March 1916.—EDS.]

No. XII.—FOOD OF BULBULS.

I am sending you separately a lizard which formed the meal of a young bulbul hatched out only about 5—6 days. The bulbul, one of a family of three Common Red-vented Bulbuls (*Molpastes hæmorrhous*), was found lying on the ground below the nest at its last gasp with the hind feet and half an inch of tail of the lizard sticking out of its mouth. I pulled the lizard out and the bird appeared better but died later. It seems rather curious for the bird to have tackled a mouthful nearly as big as itself.

B. D. RICHARDS.

LONAVLA, 15*th October* 1917.

[The lizard, a young *Calotes versicolor*, measured 3½ inches in length. The circumstance is remarkable as this bulbul is chiefly a fruit eater—EDS.]

No. XIII.—NOTES ON THE NIDIFICATION OF THE COMMON GREY HORNBILL (*LOPHOCEROS BIROSTRIS*).

Our garden at Batala, Gurdaspur District, has usually had these hornbills nesting in it. One season a predecessor of ours, the Rev. F. Lawrence, used to feed the imprisoned female hornbill from the end of a fishing rod. But this year, 1917, we had unusual opportunities of observing the details of the incubation period closely, as there was a hornbill nesting in a "jàman" tree in a hole about eighteen feet from the ground. A good view of it was commanded from an upper window and also from a first floor verandah of which the creeper-covered balustrade gave perfect cover to the observer.

The hole was on the outward side of the tree and had presumably been used by parrots. For when the hornbills were investigating the hole with a view to nesting, there was vociferous competition from the parrots. On the 2nd of April the hornbills began enlarging the hole, on the 3rd the female went in.

In the account by Mr. Horne given in Hume's Nests and Eggs of Indian Birds, Rough Draft, it is stated that the hole observed was filled up from inside by the female with her own ordure. I cannot think that a hole could have been stopped up with merely the droppings of one bird for two days in the case of my hornbills. They had a large hole to reduce to the dimensions of the small upright feeding slit, and I observed the male bringing pellets of mud from the garden irrigation channels where the water had just been running. The pellets he handed to the female appeared to be quite round, like the pellets of which a swallow's nest is built. She plastered them on from inside making the opening smaller inside than out like the slit windows in a Fort: it had a downward slope too like a windowsill. Then the hole was reduced till it had only a narrow slit which allowed a little more than the stretch of an open beak. From the time that the hole was plastered up about April 6th the female did not appear till April 22nd. The male was assiduous in feeding her. But being apparently a normal case we did not make any special observations. When on April 22nd, we saw the hole enlarged, we thought the female must be out and did not expect to see the hole closed up again. No account that I had seen or heard mentioned the fact that after the emergence of the mother, the parents shut up the remaining young again just as the mother was shut up!

The female, I may mention in distinction to Mr. Horne's account which describes an emerged female he saw as having lost many of her feathers and being in bad condition, was exceedingly well-looking and in beautiful plumage. She was easily distinguished from the male by being slightly smaller and darker in plumage.

When the female came out the hole was again reduced to a feeding slit, but as we thought the young were out too we did not watch for the hole being filled up, and I cannot say if the young birds helped to plaster the hole from inside as their mother had done.

We were much surprised at seeing the hole again blocked. From April 22nd till July 2nd the hole remained a mere slit. The male and female fed the young at frequent intervals from light till midday and then seemed to take cover from the heat themselves till about 4 p.m. The surface of the bark below and at the sides of the hole became quite worn and smooth. The food was given from two positions, the parent would alight on a bough near at hand and then fly to the hole, clinging on to the trunk below it with legs wide apart, and feed directly into the open beaks of the young. Or the bird would feed from one side of the trunk stretching its neck round the curve of the trunk to the hole. During the preliminary rest in which the food bringer often indulged, the bird frequently regurgitated the food it was about to give, shortening and stretching its wonderfully elastic neck and gulping with great swellings of the throat.

The diet was very mixed, but had certainly carnivorous elements in it. The sweeper's boy told me he had seen grass-hoppers being picked up off the ground and fed to the young, and Colonel Farmer, Superintendent of the Civil Veterinary Department of the Punjab, staying with us on June 22nd, saw the same distinctly. On June 26th, one of the parents brought a headless mouse (or lizard possibly) with a white underside. The young took it eagerly. The head was regurgitated and given separately. I think it was a mouse for the young toyed a long time with it—the opening was open that day as I shall mention later—and I saw them throwing the guts up and down playing with them on the windowsill of the hole.

A variety of food would be brought at one beakful. Pipal figs were much used, but once I noticed a green leaf regurgitated and fed in morsels to the young and the feed ended with a pipal fig. My husband on June 26th, saw one beakful consist of no less than seven figs. They were gulped up by the bringer one by one, but the last two were rejected by the young and thrown out. The male patiently picked them up several times and offered them again but they were refused. I have seen a fig thrown out by the young and caught in the beak of the mother and handed back to the young again!

On Thursday, June 29th, the diet for two hours was as follows, observed with field glasses from the balcony.

8-25 a.m., green leaf brought by male who flew off directly.
8-27 one of the first ripe jaman berries, brought by the male, rejected by the young and swallowed by the male himself.
9-7 „ green leaves, fed by the female.
9-10 „ do. do.
9-12 „ green leaf regurgitated and fed by the male.
9-30 „ green leaf and then pipal fig fed by the male.
9-33 „ something undeterminable brought by the male.
9-40 „ do. do.
10-25 „ fig, which was refused by young, brought by the male.

Nothing more was brought between then and 11 a.m., after which time observation ceased.

On June 30th observation was as follows:—

10-12 a.m., some small black thing, like an ant, fed by the female.
10-17 ,, pipal fig brought by the female.
10-26 ,, black ant brought by the female.
10-40 ,, something undeterminable brought by the male.
10-43 ,, mixed food ending with a fig, brought by the female.

After the young had left the nest, the old birds continued to feed them as they sat on the trees.

The arrival of the parent with food was nearly always announced by the young with a loud cry and we were able to run to a window and see what was being fed to them. Even when the parent sat on a bough and did not approach the hole at first, the young seemed to be able to see through their narrow slit that food was at hand.

On June 24th we heard this cry from another direction than the nest and rushed out, thinking the young were out. Strange to say the hole *was* opened, but the young hornbills were *not* those from this nest but two young ones just emerged from another nest in a mango tree in another part of the garden. The young in the jaman tree nest remained in and were regularly fed. We now watched very closely as the hole was open and we expected the young to come out any moment. But on June 27th the male was seen carrying lumps of mud to the hole and on the 28th the hole was rather smaller again, and on the 29th very distinctly filled up. On the 30th a very heavy rain with wind came and I conceived it possible that the hole had been closed on second thoughts because of the premonition of rain. The hole of the mango tree nest did not face the wind, the jaman tree did.

On the 2nd of July the hole was again opened, but the young remained in and were fed. On one day in July, in spite of much observation, the young birds flew without my being present. There were only two as in the other nest, and in each case the young birds were very little smaller than the parents and had apparently mature plumage. The birds, young or old, never came near the hole again, though there are nearly always hornbills sitting or flying in the garden.

A thing that could not but be remarked on was the accuracy of the young birds in voiding their ordure through the narrow slit, as well as the distance to which they propelled it. The ground quite a distance from the tree was white with their droppings as well as sprinkled with bits of dropped pipal figs burst. But I never saw any bones of castings such as an owl voids.

GURDASPUR, PUNJAB, ELEANOR FRANCES HALL.
October 29th, 1917.

No. XIV.—NOTE ON KALIJ PHEASANT, ESPECIALLY ON A SPECIMEN FROM THE GOALPARA DISTRICT, ASSAM.

Some years ago my friend Mr. E. O. Shebbeare of the Forest Service sent me the skin of a cock kalij shot by him at Bengtol Camp, Goalpara, on the 21st March 1909. He had provisionally marked it *Gennæus leucomelanus*, but on receipt of the skin it did not appear to me to belong to any described species. I sent the skin to Mr. Ogilvie Grant at the British Museum for identification. Not hearing from him for a long time, I wrote him about the skin and he replied that he had passed it on to Mr. E. W. Oates, who was at that time working on this group of pheasants and that Mr. Oates had promised to write to me; but as he did not do so, he said that Oates placed it as *Gennæus mearsi*.

I was greatly interested in Mr. Stuart Baker's revision of the genus *Gennæus* in No. 4, Vol. XXIII, of this Journal and also in his article on some of the species and sub-species of *Gennæus* in the last Journal (No. 2), Vol. XXV. According to Mr. Baker, Oates species *Gennæus mearsi* is nothing more and less than *Gennæus horsfieldi horsfieldi.* Under that species he makes the following remarks : "The lower plumage is very seldom marked with white, but I have seen specimens from Goalpara . . . . . again from the extreme East (*vide* Oates, *mearsi*) with five lines on the feathers of the sides of the breast and flanks, the streaks appearing either as central striæ to the feathers or, less often, on the outer web only."

Now to come to my Goalpara skin. I have not got the specimen with me at present. I believe Mr. Baker has it, but I made a most careful life size water colour sketch of half or more of the bird and have that sketch. The first thing that struck me on receipt of the skin from Mr. Shebbeare and also on examining my water colour sketch was the *lanceolate* feathers of the breast just like those of *melanonotus* and not at all like the *rounded* breast feathers of *horsfieldi.* The breast feathers have white central striæ as mentioned by Mr. Baker and quoted by me, but in Mr. Baker's article there is no mention of the breast feathers being lanceolate or rounded. I believe the breast feathers of *horsfieldi* are *invariably* rounded ; if so, then my Goalpara specimen cannot belong to that species, and if the breast feathers of *mearsi* are rounded which, I presume they are, as Mr. Baker places that sub-species as a synonym of *horsfieldi,* then my skin is not *mearsi* though named so by Oates, who originally described that sub-species. I believe my skin will turn out to be a hybrid of between *Gennæus melanonotus* and *G. horsfieldi horsfieldi,* having the lanceolate breast feathers of the former and the white barred rump of the latter. I have asked Mr. Stuart Baker to re-examine my Goalpara skin and to give us his views on the subject. It would be interesting if one could get further Goalpara specimens. I am trying to do so. I have been greatly interested in the Kalij pheasants for some time and have been collecting specimens from various parts of Darjiling and the Duars to try and find out the exact range of *Gennæus melanonotus,* which is the common species of those parts. This species is not the only one got in that region, as some years ago while shooting from an elephant in the forest near Sivoke, which is in the Kurseong Division of the Darjiling District and is situated at the foot of Hills and on the boundary of the Duars, the Tista river separating it from that District, I distinctly saw at very close range a Kalij pheasant with white bars on the rump. I quickly changed my lethal cartridges for shot ones, but in the meantime the Kalij had scuttled into some high elephant grass, and though I beat this thoroughly with the elephant, I never got another glimpse of the bird. The bird was quite close to the elephant, when I saw it and the undergrowth being thin I got a complete view of the bird and not only a glimpse ; knowing *Gennæus horsfieldi horsfieldi* well, the white bars on the rump at once drew my attention. I have tried to get specimens of white barred rumped birds from this locality and from the Duars, but so far unsuccessfully. Several of the Duars planters are interested in the subject and have promised to send me skins should they get any, and Mr. Shebbeare, who moves about the whole of the District from the Goalpara to the Darjiling boundaries, is also on the look out for specimens. So far the only pheasants I have got from the Duars have been from the Jalpaiguri Division and all *G. melanonotus,* but I hope to get some from the Buxa Division which runs up to the Goalpara District, the Sankos being the boundary. Should any pheasants be forthcoming from that Division they should prove interesting, they may be pure *melanonotus* or may be like my Goalpara specimen. Under nidification of *Gennæus leucomelanos*, Mr. Baker mentions getting some eggs of that species from Dr. H. N. Coltart which had originally been brought to Mr. Ferry from the hills above Bettiah. I have also four eggs in my collection which I got from Dr. Coltart, who received them from Mr. Ferry, and which were got from the same spot or from the hills near Bhikua Thori: they belong to two separate clutches. The vernacular name for *Gennæus melanonotus*, which I have heard in many parts of the hills, is Kalij.

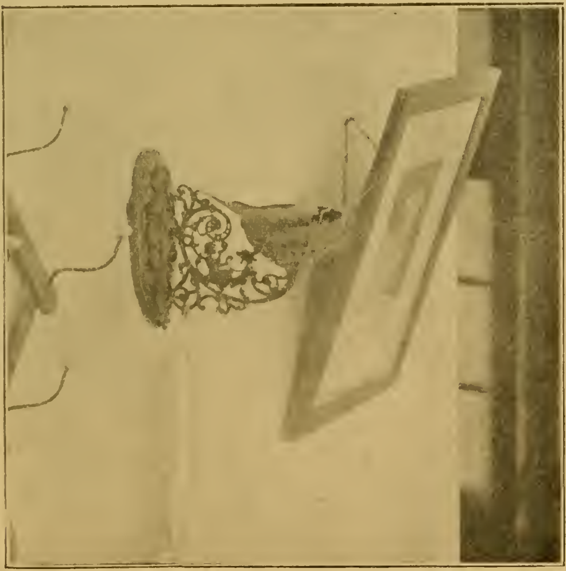
Since writing the above on the Goalpara skin shot by Mr. E. O. Shebbeare, I have come across a letter from Mr. Stuart Baker who wrote as follows about this specimen. The letter had got mislaid and I did not remember that he had made any remarks about it. He wrote "I make your bird out to be *horsfieldi* with an inclination towards the *melanonotus* form which is what one might expect at that point, Goalpara." I still wonder what the bird I saw at Sivoke could have been.

CHAS. M. INGLIS.

BAGHOWNIE FLY, LAHERIA SERAI, P.O.
9th November 1917.

No. XV.—CURIOUS POSITION OF A DOVES' NEST.

I send a photograph of a doves' nest. It was made as you will see in a



lamp bracket on a verandah which is in constant use. Nothing worried the parents and they hatched out a couple of young ones. The dove is I think *Turtur cambayensis*, the Little Brown Dove.

W. G. BARNETT.

POONA, *September*, 1917.

No. XVI.—HABITS OF THE GREEN TURTLE (*CHELONE MYDAS*).

We all know that a turtle lays its eggs in the sand, but there does not appear to be any record in the Society's Journal of exactly how this operation is performed.

When at Karachi early in July I was fortunate enough to witness the whole procedure, so send a note of the occurrence. The turtle emerged from the surf at about 5 o'clock in the afternoon, the tide being near the full, and proceeded about 40 yards inland to the foot of a cliff. She then stubbed her nose against some stones, so turned them aside until, having found a place to her satisfaction, she settled herself down with the aid of her flappers and by sideways movements of her body, until she was sunk below the sand level about two inches in front and some six inches behind.

Then, using each hind flapper in turn, she scooped out a handful of sand and deposited it to one side. As each "handful" was thus deposited, the body was moved over towards that side so as to bring the opposite flapper into position, and this was then reached down to draw up its "handful" of sand, and so on.

The hole scooped out was about 24 inches in depth, 30 inches from sand level, the depth being regulated by the utmost extent to which the flapper could reach, and this coinciding with the reach of a man's arm. Sufficient excavation having been made the turtle—panting with its exertions—lay quiet for about 20 minutes, and then, the eggs having been laid, proceeded to fill in the sand, using the flappers the reverse way to that employed for the excavation. She then drew herself slightly forward and patted down the sand over the hole with her flappers, moved her body over the place to flatten it out, and turning round crawled back the way she came, being "turned turtle" and also stood on, on the journey, and disappeared into the surf.

Throughout these operations, which took about an hour, she paid no attention to the interested lookers-on. A dog sniffed at her nose, children and "grown up's" stood around and made rude remarks, but she did not mind in the least and went steadily on with her business. Needless to add that no sooner had she vacated her position than the eggs were dug up by eager children and the spoil divided. The eggs numbered about a hundred. They were in size and shape like a ping-pong ball, including the small indentation caused, apparently, by each egg being dropped on to the others below. I let some of the eggs fall from a height of about four feet on to rock, and they bounded off undamaged; this being, no doubt, Nature's provision to enable them to be dupped on to one another from the necessary height when being laid. The turtle was about thirty inches long. I much regret the absence of a camera and neglect to accurately time the various operations. The sand at the bottom of the hole was slightly damp.

R. W. BURTON, LT.-COL.

BOMBAY, *August* 1917.

No. XVII.—OCCURRENCE OF THE TREE SNAKE *(DENDROPHIS PICTUS)* IN KUMAON.

When I wrote my popular article on this Snake in this Journal, (Vol. XIX, p. 787, *et seq.*), the only evidence that it occurs in Northern India, West of Bengal was from Stoliczka, who reported it common in Kumaon and Sutlej. Further, out of 704 snakes collected by me in Fyzabad, U. P. no single specimen came to bag.

It is interesting therefore that on my journey from Ranibag to Kathgodam at the foot of the Naini Tal Hills on the 15th of this month I came across a fine ♀ specimen.

It crossed the road holding its head some 9 inches or a foot high, having something in its jaws. Hurriedly dismounting I managed to disable the snake before it gained jungle cover, and was surprised to find it a *Dendrophis pictus*. Its intended victim which was held transversely. in the jaws as a dog carries a stick, was dropped on the road, and when picked up proved to be a large gecko (probably *Hemidactylus coctaei).* I identified the snake from its colouration chiefly, from *D. tristis* (*vide* remarks on page 779 of the article above referred to). I did not examine the dentition, nor count the ventrals and subcaudals. The costals were 15 anteriorly and in midbody, 11 posteriorly.

F. WALL, Lt.-Col., I.M.S.

Jhelum, *22nd October* 1917.

No. XVIII.—PYTHONS BREEDING IN CAPTIVITY.

A female Python (*Python molurus*) measuring 8′-6″ had been caged for four years in the vivarium of the Nagpur Museum, and on the 10th October 1916, a male measuring 5′-8″ was introduced into the same cage. At first there was a tendency to disagree but after a day or two the pair became friendly and invariably lay coiled together. After the winter fast the dam appeared to be falling off in her appetite and began to refuse food offered to her. In February she ate but one chicken and a rat, in March nothing, in April only one rat, after which she refused food entirely. On 12th May she deposited 16 eggs. Deposition began at about 7 A.M. and ended at 2 P.M. The snake lay coiled during the process and as each egg was laid she proceeded to cover it with her coils.

One egg which was opened contained an embryo in an early stage of development which measured 3 inches when unravelled. The heart was seen pulsating and the hind limbs were indicated by two minute prominences. The weight of this egg was 6¼ oz.

On the following day it was noticed that she had completely covered seven eggs under her coils and rejected the rest. This was probably due to her inability to cover more than seven eggs or they may have been put out of place by the movements of the male snake which still remained in the same cage. These eggs measured as follows:—

1. 3·4″ × 2·5″
2. 3·8″ × 2·4″
3. 3·4″ × 2·3″
4. 3·6″ × 2·5″
5. 3·7″ × 2·5′
6. 3·1″ × 2·5″
7. 3·5″ × 2·2″
8. 2·2″ × 1·8″
9. 2·5″ × 1·9″

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS.

All contained embryos similar to the one described, except Nos. 6, 8 and 9 which were unfertile, 8 and 9 were discoloured and not fully formed, while 6 was joined to 5.

The snake incubated these eggs till 30th June and throughout the period she was noticed twitching at short intervals. On the 2nd June she left the eggs, had a drink and after immersing herself in the watertank returned to the eggs. On the 16th June she ate a dead rat and a bird placed near her. On the 30th June she left the eggs which were removed and examined. All proved to be addled except one which contained a living snake 14¼″ long and about ¾ of an inch in thickness. The fœtal tooth, which ended in a blunt point was distinctly visible to the naked eye.

The dam had sloughed on the 7th April before the incubation period and did not shed her skin again till the 19th July.

E. A. D'ABREU, F.Z.S.

CENTRAL MUSEUM, NAGPUR,
8th August 1917.

No. XIX.—THE VARIETIES OF COBRAS IN CENTRAL INDIA.

Please see Col. Bannerman's paper on the distribution of varieties of Cobra in Vol. XVI, page 638, and Vol. XVII, page 1031, of our Journal.

Central India is mentioned as the habitat of the variety *caeca*.

On 3rd June a Cobra was brought to me of the ordinary "*typica*" variety with well developed ocellate marks. It was 3′-10″ in length.

On the 11th June I was brought a Cobra of the variety "*caeca*" 4′-3 long. I made a careful lepidosis of the snake although I was certain tha it could be nothing else. So far as I recollect Goona is the only place given in Col. Bannerman's map, lying in Central India. Here (Manpur) the two varieties occur. It will be interesting to see which prevails when more have been collected.

C. E. LUARD, MAJOR.

THE AGENCY, MANPUR, C. I.,
2nd September 1917.

No. XX.—COBRAS WITHOUT THE CUNEATE SCALE.

I am sending to-day the head of a snake which was killed by a servant in the compound last night. I proceeded to identify it this morning and at once came to the conclusion that it was a Cobra (*Naia tripudians*) on the following points:—

1. 3rd supra-labial touches nasal shield and eye. This separates Cobras and Coral snakes from *all* other snakes, *vide* Wall's "Poisonous Terrestrial Snakes," page 23.
2. 'The præocular shield touches the internasal', peculiar to the cobras with two rare exceptions (page 28 same book).
3. Other marks as tail, etc., point to the Cobra and scale pattern on back makes distinct chevron shape.

I went over all this most carefully and could not find that I was mistaken in any point *but* I could find no 'cuneate' scale and the scales differ in the two following points. The 2nd temporal does not touch 5th and 6th supralabials but the 4th and 5th, and the 4th supra-labial does not touch the eye as figured in Wall's book, page 29. I have not identified many snakes and most of those of this part of India are new to me, but this species which I have once before examined and taken for a Cobra puzzles me. I should be much obliged if you would let me know what species it is and how the apparently contradictory 'marks' can be explained. I could find no fangs but took it that they might have been knocked out.

NOWSHERA, N.W.F.P., H. R. WATSON, MAJOR,
1st April 1917. 31st Pioneers.

[Since writing the above, Major Watson has sent us another Cobra from Nowshera *without the cuneate scale.* This led us to examine all the specimens of Cobras in our collection and we found, out of 56 specimens from all parts of India, 2 (from Parachinar and Taungyi, Burma) without any cuneate scale.—EDS.]

No. XXI.—FIGHT BETWEEN *VESPA CINCTA*, FABR., AND *POLISTES HEBRAEUS*, FABR.

The other day while in the Factory, I saw two wasps (*V. cincta,* Fabr., and *P. hebraeus,* Fabr.) so to speak clasped in each others arms (legs). They were in the air but came down to the ground and there rolled about like a pair of wrestlers, each stinging the other for all he knew. After a few minutes the larger wasp flew away leaving the other, crippled but not defunct, on the ground.

CHAS. M. INGLIS.

BAGHOWRIA FTY, LAHERIA SARAI,
2nd Aug. 1917.

No. XXII.—THE INFLUENCE OF THE MONSOONS ON INSECT LIFE IN INDIA.

On the 9th of November, after dark, at about 120 miles W. S. W. of Bombay, quite a number of insects came on board the Hospital Ship "Madras." Amongst these I noticed the Sphingid, *Chaerocampa theylia*, some undetermined Geometers and two species of dragonflies—*Diplacodes trivialis,* an insect with a weak flight and *Tholymis tillarga,* a night-flying species. A moderate N. E. monsoon was blowing at the time which is ordinary for the time of the year. It would be impossible for any of these insects to beat up against the wind for a distance of 120 miles, especially for the weaker flying species, and it would be equally impossible for any of them to survive the vast distance separating them from the African coast. The paucity of Indian forms amongst the African fauna bears out this latter point. The monsoons must therefore be immensely important factors in keeping down insect life in India, as incalculable numbers must be blown out to sea, eastwards or westwards according to the prevailing monsoon, and there perish. A calculation based on the numbers coming aboard any ship during the course of a single day, the breadth of beam of the ship and the extent of coast-line to windward will give some idea of these numbers and incidentally of the wealth of our Indian fauna which can spare such great losses over many weeks without showing any appreciable diminution.

F. C. FRASER, CAPT., I.M.S.

Hospital Ship "Madras,"
BOMBAY, *Nov.* 1917.

No. XXIII.—THE DISTANCE MOSQUITOES CAN FLY.

In our Journal for 1905, Vol. XVI., page 36, Patton, in his article on "The Culicid Fauna of the Aden Hinterland—their haunts and habits" gives the maximum flight of Anopheline Mosquitoes as observed by him at that time as 1¼ miles.

It may be of interest to record here that while the Hospital Ship "Madras" was lying off the bar of the Shatt-el-Arab about lat. 29′-46′, long. 48′-47′, 15½ miles from the nearest land on the 28th May 1916, swarms of *Cellia pulcherrima* appeared on the ship. I do not think there is any doubt that they came from the shore. As far as I know there was not a single mosquito observed on the voyage up from Bombay, but on the day after our arrival at the bar *C. pulcherrima* was biting freely in the saloon and numerous specimens were caught and identified.

A search was made on board for a possible breeding place with—as might be expected on a Hospital Ship—a negative result.

The light-ship lay about a mile off; no other ship was nearer than the land, a light breeze blew from the shore. This is not the only occasion on which *Cellia pulcherrima* has visited the ship at the bar, they have been frequently caught after the ship's arrival. On the 12th of September this year I caught three in my cabin. I have never taken any mosquitoes on the voyage up to the bar except *Culicinae.*

ROBERT E. WRIGHT, MAJOR, I.M.S.

HOSPITAL SHIP "MADRAS",
3rd October 1917.

No. XXIV.—PHOSPHORESCENCE IN THE PERSIAN GULF.

Many of our members have probably travelled from Bombay to Basra in the last three years, and some or them have doubtless been struck by the wonderful phosphorescent phenomena of the Persian Gulf. Phosphorescence may be observed in these waters in varying degrees of brilliance at practically any time of year. I cannot say at what time it is at its best but I have never seen anything comparable to a night early in March 1916, between the Farur Islands and the bar of the Shatt-el-Arab. It was a fine still night, the Hospital Ship "Madras" was steaming towards Basra, all around the vessel the water was glowing with pale bue light, the ripples thrown out on either side stretched away in diverging lines of flame, towards the horizon, the sea was illuminated by the glowing crests of waves, a depth of fiery liquid boiled round the bows, and the wake shone like a moonlit river.

The vessel herself was illuminated with a pale ghostly light. The fish darting about in the water close by, made their presence known by developing rocket like trails. The ship's cat, sitting in "the chains," watched these rapidly moving streaks intently; as if he knew that they were produced by something that was fair game. With difficulty we, who were watching, tore overselves away from the fascinating spectacle, but before going to bed a salt-water tap was turned on and a number of glowing balls of fire captured. On investigation it appeared that the creatures of the floating fauna mainly responsible for the night's illuminations were little Crustaceans, easily visible to the naked eye, belonging to the groups Cladocera and Copepoda.

On superficial examination with a low-power glass, the chief representations of the former looked like minute pink bivalves, whilst those of the latter resembled to a certain extent minute shrimps.

In immense numbers they form part of the "plankton" which one hears referred to by seafaring men as "whale spawn" amongst other names.

ROBERT E. WRIGHT, MAJOR, I.M.S.

HOSPITAL SHIP "MADRAS,'
3rd October 1917.

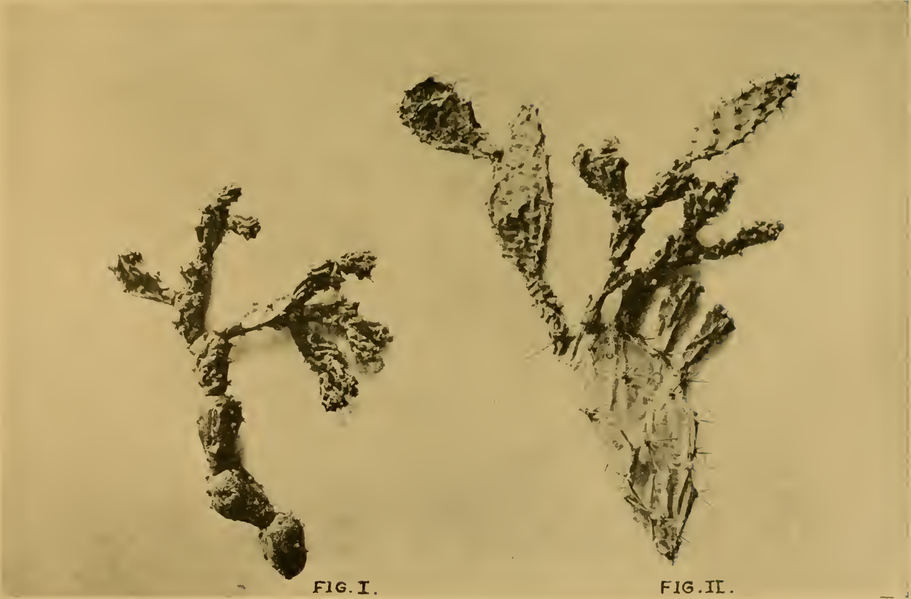


FIG. I. FIG. II.

PHENOMENA OF INTERCHANGEABILITY OF VEGETATIVE AND FRUIT STRUCTURES IN *OPUNTIA ELATA*.

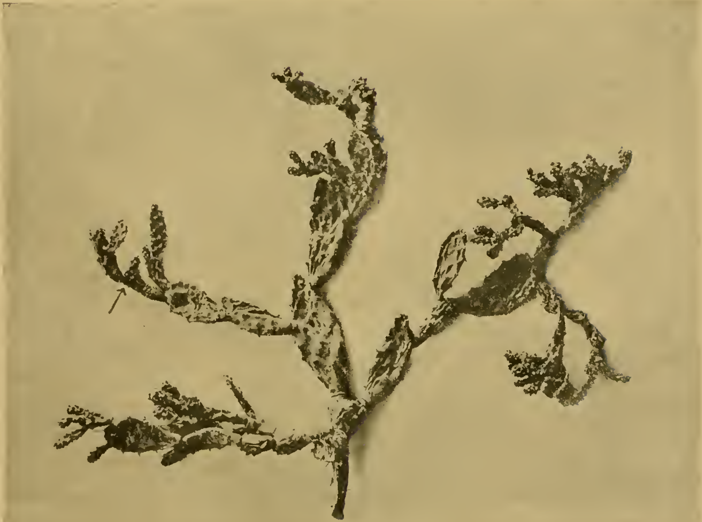


FIG. III

PHENOMENA OF INTERCHANGEABILITY OF VEGETATIVE AND FRUIT STRUCTURES IN *OPUNTIA ELATA.*

No. XXV.—PHENOMENA OF INTERCHANGEABILITY OF VEGETATIVE AND FRUIT STRUCTURES IN *OPUNTIA ELATIOR*, MILL.

(*With Plates I and II.*)

In many a village of the Deccan, this *Opuntia* occurs gregariously filling up all unoccupied spaces of the village site. It is also found growing as a tall and compact hedge along boundaries of cultivated fields bordering on much frequented village paths or cart tracks. In these positions it forms a pest of the village as it harbours wild pigs, snakes and other obnoxious creatures.

This Cactus (prickly pear) usually bears its crimson coloured fruits on the margins of phylloclades in variable numbers. Sometimes two or three are found to occur at the same level growing near each other. In the ordinary course, these fruits drop down on ripening. In size they are about 1¼ inch to 1¾ inch by 1¼ to ¾ inch pear-shaped and deeply coloured. Sometimes one finds a fruit growing from the top of a sister fruit. Dr. William Burns mentions (*vide* Agricultural Journal of India, Vol. IX, Part IV, pages 336-365) a case of a negative structure growing from the fruits of this species of Cactus. But the peculiarities presented by the subjects photographed in figures I, II and III are not recorded. The specimens pictured here were found growing as branches of individual plants in the village hedge-row at Bhatkunki, a village in the Bijapur district (Lat. 17° N., Long. 76° E. approximately). They were collected by the writer on 27th May 1914.

In Fig. I is to be seen a succession of 4 fruits place one upon another growing in succession. The fourth or the topmost one bears at its rim, other fruits which again have another succession of 3 or bunches of fruits, the last maintaining the same kind of succession again. At the extremity of each bunch are to be seen dried remnants of one or more flowers. In this specimen (Fig. I) the usual colouration of the fruit was fully developed upon the lowermost four fruits. In the upper ones also although the intensity of the colour gradually diminished from bottom to top ones (increasing to green) still a tendency to develop it more and more according to the maturity of the fruit was to be seen here very clearly indeed. I cut open all the four lower fruits. They were full of soft pulp which tasted rather insipid or very slightly sour. No seeds were found. The two fruits on the upper branches were also examined. They were rather hollow not containing any pulp, but had some juice. One seed was found in each.

In Fig. II we find a phylloclade which has produced marginally five fruit structures, two of which had fully developed the normal coloration and are devoid of any lateral branching. The three others were not so deeply coloured. One of these has produced two joints successively. From one of the remaining, a fruit is produced which again bears three sister fruits from its top and a phylloclade from one of the last. The second bears a succession of fruits.

Fig. III is a still more curious specimen. In this, one can see alternate developments of fruits and joints from one another and a string of fruits also. A transitional stage is to be seen at ↗7. I cut open the middle lowermost, thick and swollen fruit of the specimen photographed here. It contained juice and one fairly large seed.

The seeds found from specimens of figures I and III were unfortunately lost before they could be sown.

In the three specimens above described, it was noticeable that the fruits were always more strongly coloured and the phylloclades generally green, although these also, now and then, presented pink colour. Besides their shape, the presence of a terminal hollow with a marginal rim and the remains of a few floral parts specially stamens indicate their real nature. The phylloclades were generally green flattened out normally elliptical lanceolate or obovate.

Ordinarily we do not find cases of vegetative phylloclades growing from the top of a normal fruit. The subject of the right hand picture of plate XXXI in Dr. Burns' article quoted above was a specimen cultivated by me in a pot in the Ganeshkhind Botanical Gardens, Kirkee, India. Not having myself noticed previously *in nature* such vegetative out growths of phylloclades from fruits, I referred to Dr. Burns personally. He informed me that he had repeatedly seen joints growing from *unripe* fruits dropped on ground.

In the cases presented here these growths were found *on ripe* as well as green fruits while themselves standing on parent members which latter were either fruits or phylloclades. Besides we see in them additional features of interest.

The above facts indicate the interchangeability of vegetative and reproductive structures in this plant.

G. B. PATVARDHAN,
Assistant Prof. of Botany.

AGRICULTURAL COLLEGE,
POONA, *Sept.* 1917.

No. XXVI.—A SPORT FROM *OPUNTIA ELATIOR*, MILL.

(*With Plate III.*)

On the evening of 23rd May 1917, on my way to one of the fields of the Jagirdar of Bhatkunki (Lat. 17° N., Long. 76° E. approximately) a village in the Bijapur District, India, I happened to notice, casually, a curiously appearing form of Cactus peeping from amidst a hedge of our common Cactus (*Opuntia elatior*). A close inspection of it revealed that the form was growing as a branch sport from one of the flat joints of the indigenous Opuntia. I showed it at the time to a student of our College, Mr. G. C. Limaye, two of his uncles and another gentleman (Mr. M. R. Bhide of the Ferguson College, Poona) who had accompanied me. I got it collected and brought it with me to Poona. A photograph of it Fig. IV (2) taken here shows the kind of structure that it has. It was so strangely different from the common Opuntia of our hedges, namely *Opuntia elatior*, Mill, that I thought it must be recorded. It appears to me a bud sport from one of the hedge plants. It was found growing from the region (A) on the subject represented in Fig. IV (1). It is regrettable that the two subjects could not be photographed while remaining attached to each other as they were collected separately. Because, also, there was no photographer on the spot and if one had been present, it would have been very difficult to isolate a sporting plant from the crowds of the hedge for photographing *in situ.* The plant has cylindrical joints of varying length, the older ones are longer than the young ones. The terminal joints bear globular or oval protuberances produced at every position of an areole. They consist of a glabrous green lower part and an upper part with tufted hairs which are interspersed with minute fleshy coloured scale. Thorns are absent.

The whole branch as collected was planted in a pot. But the lower thickest part got rotten soon. Slips from the upper joints are planted and are expected to thrive.

G. B. PATVARDHAN,
Assistant Prof. of Botany.

AGRICULTURAL COLLEGE,
POONA, *Sept.* 1917.

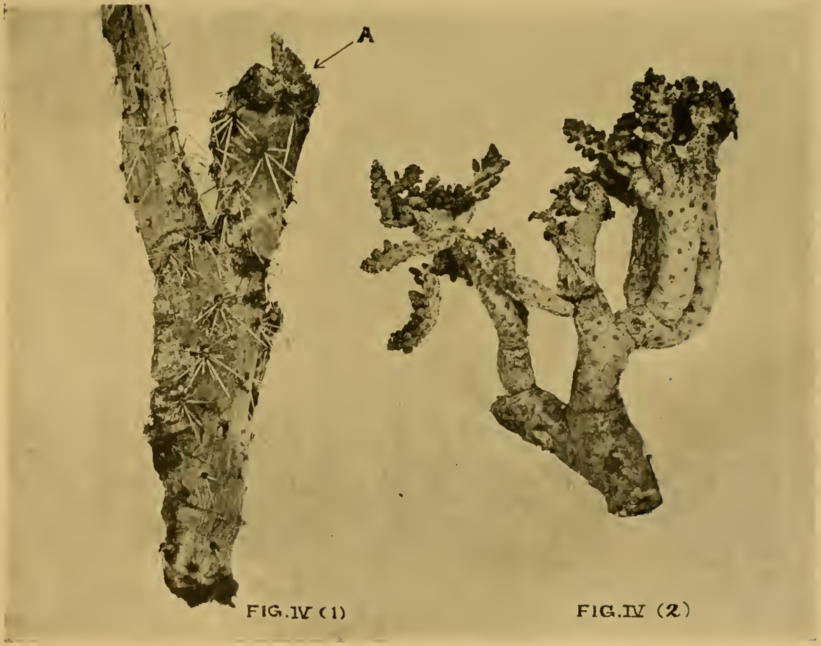
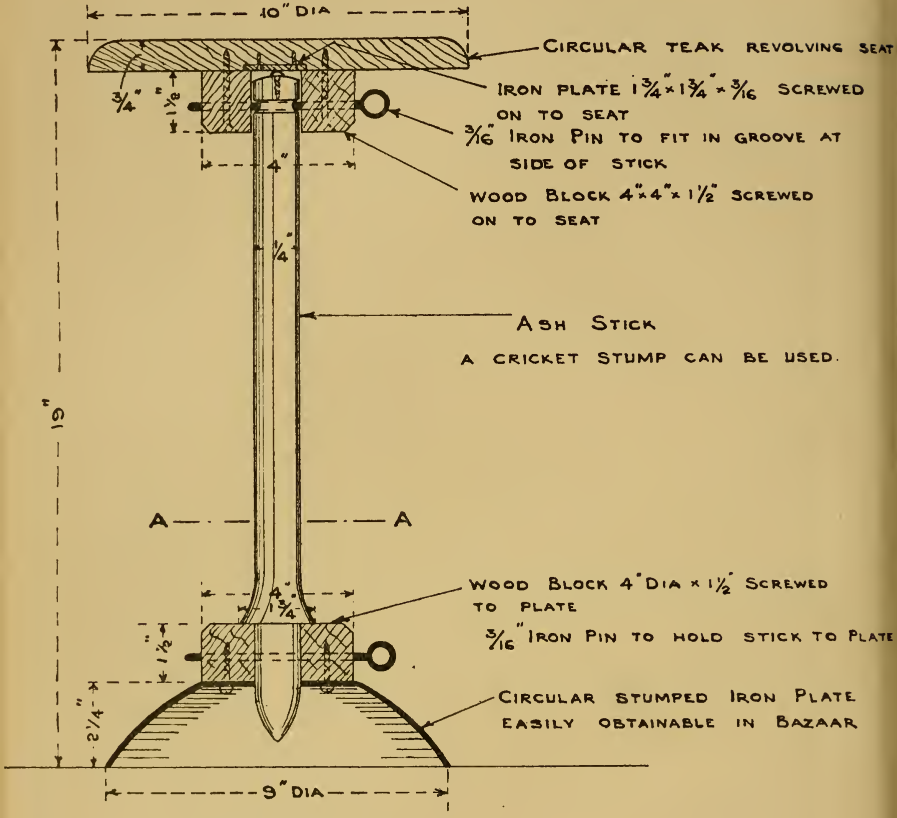


FIG. IV (1)

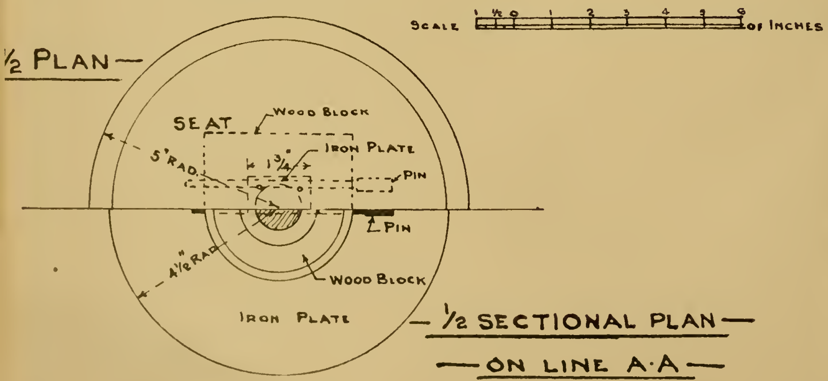
FIG. IV (2)

PHENOMENA OF INTERCHANGEABILITY OF VEGETATIVE AND FRUIT STRUCTURES IN *OPUNTIA ELATA*.

BARTON SHOOTING SEAT


10" DIA
CIRCULAR TEAK REVOLVING SEAT
IRON PLATE 1¾"×1¾"×3/16 SCREWED ON TO SEAT
3/16" IRON PIN TO FIT IN GROOVE AT SIDE OF STICK
WOOD BLOCK 4"×4"×1½" SCREWED ON TO SEAT
¾"
1⅛"
4"
¼"
ASH STICK
A CRICKET STUMP CAN BE USED.
19"
A
A
4"
1¾"
WOOD BLOCK 4" DIA × 1½" SCREWED TO PLATE
3/16" IRON PIN TO HOLD STICK TO PLATE
1½"
2¼"
CIRCULAR STUMPED IRON PLATE EASILY OBTAINABLE IN BAZAAR
9" DIA

SECTION


SCALE
1
½
0
1
2
3
4
5
6
OF INCHES
½ PLAN
SEAT
WOOD BLOCK
IRON PLATE
1¾
PIN
5" RAD.
PIN
4½" RAD
WOOD BLOCK
IRON PLATE

½ SECTIONAL PLAN
ON LINE A·A

No. XXVII.—THE BARTON SHOOTING SEAT.

(With a plate.)

About 15 years ago Mr. E. L. Barton, who was then in Bombay and a member of our Committee, invented a portable revolving shooting seat which was found to be peculiarly suitable for duck shooting. A certain number of the seats were made and sold to members of the Society. A recent enquiry from a member for one of these seats has elicited from Mr. Barton, who is now living in England, a rough sketch from which I have prepared the sketch and plan given on the accompanying plate.

The seat can be taken to pieces and packed in a small canvas bag.

It is thought that the sketch may be of use to some members who require a revolving seat (for duck shooting) which will not sink in the mud.

L. H. SAVILE.

BOMBAY, *December* 1917.

PROCEEDINGS

OF THE MEETING HELD ON 26TH JULY 1917.

A meeting of members and their friends of the Bombay Natural History Society took place on Thursday, the 26th July, Mr. John Wallace presiding.

The Secretary said since the last meeting the Society had lost by death two of their oldest members the Revd. Father Dreckmann, S.J., and Lt.-Col. Kirtikar, I.M.S. Father Dreckmann was for 30 years a member of the Committee and until recently one of the Vice-Presidents of the Society. He was one of the most regular attendants at the meetings and had done a great deal of valuable work for the Society in connection with reptiles. Lt.-Col. Kirtikar was a member of the committee for many years and had contributed many valuable notes on Botanical subjects.

The Secretary said he was sure that members would pass a vote of deep regret at the loss of these old and valued members both of whom had helped so largely in the researches of the Society.

The election of the following 23 new members since the last meeting was announced:—The Secretary, Darjeeling Gymkhana Club, Darjeeling; Capt. E. Selby Phipson, I.M.S., Bombay; Capt. J. S. Armstrong, R.A.M.C., Basra; Capt. the Hon'ble R. A. Addington, Poona; Mr. J. C. T. Fairweather, Khandwa, C.P.; Capt. H. F. Murland, Karachi; Mr. C. R. Partridge, Jalpaiguri; the Honorary Secretary, Station Library, Simla; Mr. H. J. Winch, Shivrajpur; Lt. E. J. Green, I.A.R.O., Mesopotamia; Lt. E. D. A. Cuvelier, Nowshera; Mr. C. P. Vitty, Europe; Mr. A. E. LeMarchand, Indore; Major A.H. Cunningham, R. E., Roorkee; Mr. F. D. Spencer, Siam; Mr. W. D. Wheeler, Bombay; Capt. A. Fitzgerald, Bombay; Capt. J. G. P. Drummond, Kacha, Baluchistan; Mr. Hasan C. Latif, Aurangabad; Lt. F. Kingdon Ward, Mesopotamia; Mr. A. E. Elmore, Tharrawaddy; the Forest Botanist, Forest Research Institute, Dehra Dun; and Capt. N. H. Prendergast, Miranshah.

The Secretary acknowledged the following contributions to the Museum since the last meeting:—

Contribution.	Locality.	Doner.
1 Fox (*Vulpes*, sp.)	Mesopotamia ..	Lt. T. R. Livesey.
1 Jackal (*C. aureus*)		
1 Wolf (*C. lupus*) (body skin only.)		
2 Hyænas (*H. hyaena*) (skins damaged).		
1 Short-eared Owl (*A. accipitrinus*) and several Snakes..		
104 Birds' skins	Do. ..	Capt. C. R. Pitman.
16 Fish	Do.	Capt. H. L. Mackenzie, I.M.S.
3 Lizards		
8 Snakes and a few insects ..		
33 Birds' skins	Do. ..	Sir P. Z. Cox.
2 Ibex heads (*C. ægagrus*) ..	Pushti Koh Range	Capt. Napier.
1 Marten (*Martes*, sp.) and ..		
1 Cheetah (*C. jubatus*)		

Contribution.	Locality.	Donor.
2 Heads of Persian Gazelle (*G. subgutturosa*)	Mesopotamia	F. Ludlow.
1 Fox (*Vulpes*, sp.)		
1 Persian Gazelle (*G. subgutturosa*) alive.	Do.	Lt. R. E. Cheesman.
6 Jerboas (*J. loftus?*) alive		
1 Gerbille (*Gerbillus*, sp.), alive		
12 Snakes	Do.	Capt. L. H. Mackenzie. Capt. C. R. Pitman.
5 Lizards		
2 Scorpions		
1 Terapin (*C. caspica*) and		
A few Insects		
20 Snakes	Do.	Maj. F. E. Venning. Capt. C. F. Ingoldby.
9 Snakes	Do.	Lt.-Col. F. Wall, I.M.S.
1 Marbled Teal (*M. angustirostris*).	Do.	Col. H. S. Wood.
1 Snake (*L. diadema*)	Do.	Capt. S. J. Hearn.
1 Fish (*Barbus seich?*)	Do.	Maj. Light.
Few Insects	Do.	Maj. F. P. Connor.
2 Markhor heads (*C. falconeri*).	No locality	Maj. E. H. James.
2 Martens (*Mustela*, sp.) and		
1 Snow Partridge (*Lerva nivicola*).		
1 Porcupine (*H. leucura*)	Lushai Hills	H. A. Coloquhoun.
1 Malabar Civet (*V. civettina*)	Trevandrum	Trevandrum Museum
1 Flying Squirrel (*T. himalaicus*).	Chumbi Valley	C. H. Dracott.
1 Palm Civet (*P. niger*)	Hissar, Punjab	C. E. Branford.
2 Rats (*E. rufescens*)	Purulia, Bengal	H. M. Crawford.
2 Palm Squirrels (*F. pennanti*).		
1 Ferret Badger (*H. nipalensis*).	Hasimara	H. V. O'Donel.
1 Bat (*Kerivoula picta*)		
1 Otter (*L. ellioti*)	Dharwar	J. R. Jacob.
1 Jackal (*C. indicus*)	Risalpur, N. W. F. P.	Lt. G. C. Shortridge.
1 Southern Mole Rat (*G. kok*)	Ootacamund	L. H. Savile.
1 Rufous-necked Hornbill (*A. nepalënsis*).	Darjeeling	N. A. Baptista.
1 Black-browed Flycatcher (*C. burkii*).	Cachar	J. P. Mills.
14 Birds	Madura District	S. H. Prater.
3 Snakes and a few fish		
1 Hawk Owl (*N. scutulata*)	Nelimpatty Hills	A. M. Kinloch.
5 Earth Snakes (*Silybura*) and		
1 Leech		
4 Birds' skins	Mount Victoria	P. F. Wickham.

Contribution.	Locality.	Donor.
5 Birds' skins .. .. .. 11 Nests and .. .. .. 3 Eggs of Reed Warbler (*A. stentoreus*).	Various	F. Field.
1 Painted Tree Snake (*D. tristis*).	Manpur, C. I. ..	Major C. E. Luard.
1 Indian Monitor (*V. bengalensis*).	Godhra, C. I. ..	I. Ali.
2 Sea Snakes	Bombay	W. Alcock.
1 Anamallay Viper (*A. anamallensis*).	Nagercoil, S. India	D. G. Cameron.
1 Golden Tree Snake (*C. ornata*)..	Minbu, Burma ..	C. G. Stewart.
2 Cobras (*N. tripudians*) ..	Nowshera ..	Maj. H. R. Watson.
3 Koels' eggs (*E. honorata*) ..	Bombay	W. S. Millard.
Eggs and nest of Madras Red-vented Bulbul (*M. hæmorrhous*).	Do.	E. C. B. Acworth.
29 Fish	Walwan Lake, Lonavla.	B. D. Richards.

Minor contributions from Messrs. G. Rose, F. Lobo, F. Hearson, Maj. G. Husband, Major Shaw, F. S. Xavier, C. Narayan Rao, Major Hilson and C. H. Donald.

PROCEEDINGS

OF THE MEETING HELD ON 26TH SEPTEMBER 1917.

An "At Home" for members and their friends of the Bombay Natural History Society took place on Wednesday, the 26th September.

The election of the following 16 new members since the last meeting was announced:—Major J. C. Coldstream, I.A., Bombay; the Curator, State Museum, Puddukkottai; Mr. N. C. Braham, Siam; Mr. W. Davies, Poona; Mr. J. G. Hogan, Indore, C.I.; Mr. E. A. Steward, Assam; Dr. H. C. Berlie, Bunder Abbas; Mr. H. G. Spence, Rangoon; Mrs. F. Hastings, Bombay; Second-Lieut. G. T. H. Bracken, Bombay; Second-Lieut. R. Smales, Bombay; the Registrar, Burma Educational Syndicate, Rangoon; the Honorary Secretary, Tavoy Club, Tavoy, Burma; H. H. the Maharaj Rana Udaibhan Sahib Bahadur of Dholpur State, Rajputana; Mr. F. E. Mackwood, Colombo; the Department of Biology, Ewing Christian College, Allahabad.

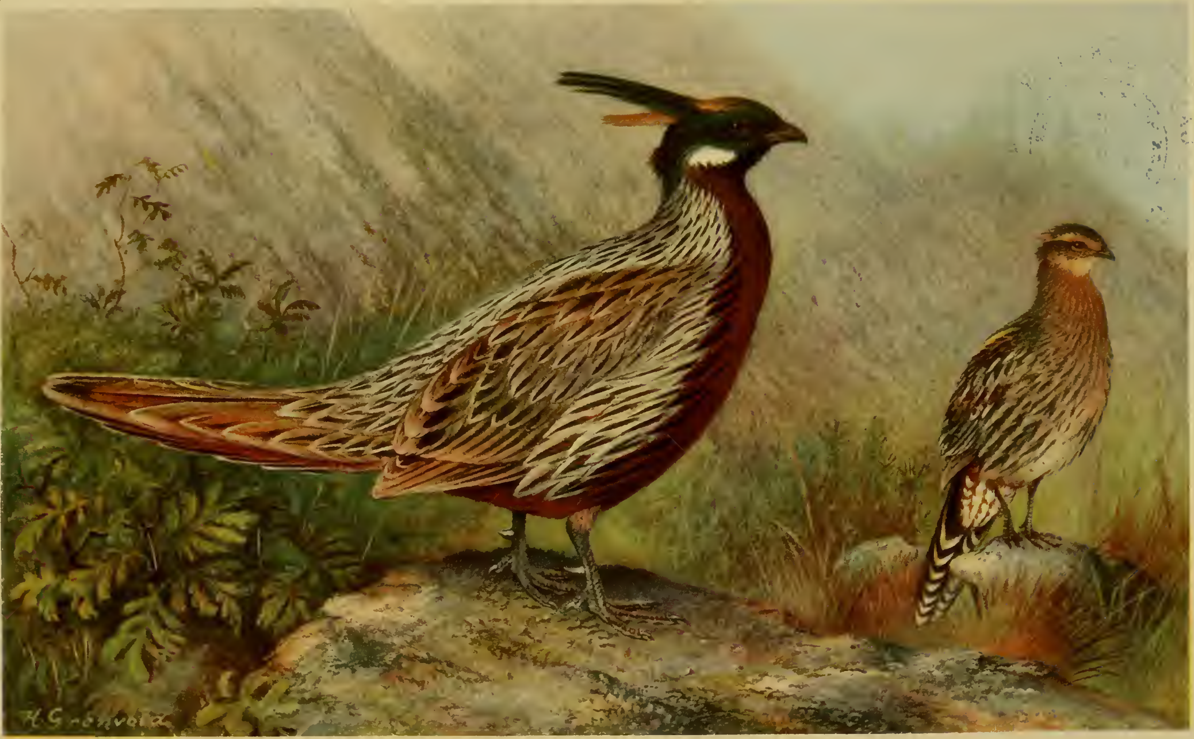
The Secretary acknowledged the following contributions to the Museum since the last meeting:—

Contribution.	Locality.	Donor.
25 Birds' skins .. .. 12 Mammals .. .. .. 17 Fish, Snakes and Lizards ..	Mesopotamia ..	Capt. C. R. Pitman.

Contribution.	Locality.	Donor.
Eggs of Indian Roller (*C. indica*).	Mesopotamia ..	Capt. Thornhill.
Persian Bee-eater (*M. persicus*).		
Great Stone Plover (*E. recurvirostus*).		
Swallow Plover (*Glareola*, sp.)		
4 Hey's Seesee Partridges (*A. heyi*), alive.	Muscat ..	Capt. C. W. Sanders.
2 Box Fish (*O. cornutus*). ..		
2 Snakes and		
1 Scorpion		
23 Birds' skins	Do. ..	Do.
1 Jackal (*C. aureus*) ..	Mastung, Baluchistan.	Capt. J. E. B. Hotson.
5 Afghan Hedgehogs, (*E. megalotis*).		
6 ,, Gerbills (*M. erythræus*).		
2 ,, Mouse Hares (*O. rufescens*) and		
1 Grey Hamster (*C. phæus*).		
2 Leopard Cats (*F. bengalensis*), alive.	Siam	E. W. Trotter.
2 Spiny Mice (*P. lasiurus*) ..	Coonoor	Lt.-Col. F. Wall, I.M.S., C.M.G.
1 Tree Mouse (*V. oleracea*) ..		
2 Shrews (*Crocidura*, sp.) ..		
21 Snakes		
13 Lizards and		
36 Frogs		
Hair-crested Drongo (*C. hottentota*).	Kangra	C. H. Donald.
Eggs of Chestnut Bittern (*A. cinamomea*).	Monacherra, Assam.	W. H. O. Shortt.
Yellow Bittern (*A. sinensis*).		
Eggs of Eastern Bayer (*P. megarhynchus*)	Cachar, Assam ..	J. P. Mills, I.C.S.
Hodgson's Broadbill (*S. rubripygius*)		
Nepal Babler (*A. nepalensis*)		
2 Tree Snakes (*D. forsteni*), alive.	Champaran ..	P. Broucke.
6 Sea Snakes	Alibag, Bombay ..	W. O. Alcock, I.C.S.
1 Fat-tailed Lizard (*E. macularius*), alive.	Cherat	Capt. A. R. W. Tate.
4 Snakes	Zairat, Baluchistan.	C. Acton.
1 Horsfield's Tortoise (*T. horsfieldi*).	Wano, Waziristan	W. B. Cotton, I.C.S.
1 Chamæleon (*C. calcaratus*), alive	Narsingpur, C. P.	P. S. Pattuck.

Contribution.	Locality.	Donor.
Giant Stick Insect	Nagercoil, S. I. ..	D. G. Cameron.
Several Insects	Satara	Mrs. N B. Kinnear.
2 Spiny Lobsters	Singapore ..	Capt. Rodgers.

Minor contributions from Messrs. W. S. Millard, H. R. Hume, C. Narayan Rao, D. G. Cameron, L. B. Holland, C. D. Crofton and L. H. Savile.



MENPES PRESS, WATFORD

PUCRASIA MACROLOPHA.

The Koklass Pheasant.

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS.

JOURNAL

OF THE

Bombay Natural History Society.

JUNE 1918. VOL. XXV. No. 4.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U.

PART XXIV.

With a Coloured Plate.

PHASIANIDÆ.

Genus—*PUCRASIA*.

This genus differs from the true Pheasants (*Phasianus*) in having greatly lengthened upper tail-coverts, together with a proportionately shorter tail, the feathers of which are graduated so that the central, and longest, rectrices are about twice the length of the outermost pair. The head has a well-developed crest, in addition to which the feathers above the ear-coverts are elongated into two long lateral plumes, contrasting in colour with the occipital crest. There is no bare orbital space, the sides of the face being feathered.

The wings are rounded, the first primaries being very short and the second about equal to the eighth.

The tarsus is stout and strong, and in the male is armed with a spur, generally short and blunt.

SPECIES AND SUB-SPECIES.

The Koklas Pheasants belong to a genus which extends over an immense area of country, stretching from the Western Himalayas in India through Tibet and China into Manchuria.

Naturally, therefore, we find that it splits up into a considerable number of species and sub-species, but it is not always easy to decide what forms are deserving of the rank of species and what should be merely designated sub-species or geographical races of those species.

Adhering to my rule that the classification which is most convenient is also the most scientifically sound, I accept four forms, or groups of forms as sufficiently well-defined from one another to merit the title of species. In no case can any one of these four forms be mistaken for another, and in no case is there a line between the two in which they merge into one another in such a manner as to make it in the slightest degree difficult to say to which they belong.

The two points in the plumage of the various Koklas Pheasants which in combination make discrimination between them easy are: (1) The colour of the tail feathers, and (2) The pattern of the feathers of the back. The first feature divides them into two well-defined groups, and the second breaks each of these up yet again into two further divisions.

Beebe, who uses only the pattern of the upper plumage as a distinguishing feature, places *P. meyeri* as a sub-species of *P. xanthospila*; this, however, it certainly is not, as the tail of the two forms are utterly different, but as the back plumage pattern on the other hand is equally different to that of *P. macrolopha*, it must stand as a species intermediate between these two. The fact that its tail is like one species and its back like another, does not alone reduce it to a form such as would constitute a sub-specific link between the two for this combination of features is quite definite, and does not shew—as far as we know at present—any sign of merging into the other forms.

As regards the sub-species into which they may be further divided, in these, of course, the differences are only a question of degree and though they are sufficiently pronounced within certain areas to enable us to give them a definite status as geographical races, yet on the confines of each area we find perfectly intermediate specimens, which we may allot to either of the adjacent sub-species as it best pleases us.

In "Zoologica" Beebe thus describes the differences in the three species he accepts.

> "In *macrolopha* the mantle feathers are cold ashy grey,
> "with a wide black shaft stripe extending almost to the tip. .
> "A white wedge has been driven some distance up the shaft, but
> ". . . is not visible when the feathers are in place.
>
> "In *xanthospila* and its congeners . . . there are two
> "lines of black instead of one.
>
> "In *darwini* two additional lateral white wedges have ap-
> "peared, splitting the two longitudinal black lines into
> "four."

If, however, *darwini*, is to rank as a full species on account of the different pattern of the upper plumage, then, *ipso facto*, we must raise *meyeri* to the rank of species on the ground of the totally different tail colouration. We then have, as I have already shewn, four species and five sub-species with the following key:—

A.—Basal portion of tail feathers black, more or less marked with rufous.

- a^1. Feathers of back with single black central streak.
  - a^2. Sides and flanks principally grey.
    - a^3. No red nuchal collar ... *macrolopha macrolopha.*
    - b^3. A red collar on nape ... ,, *biddulphi.*
  - b^2. Sides and flanks principally black with narrow grey edges ... ,, *nepalensis.*
  - c^2. Sides and flanks principally chestnut with little black or light marking ... ... ,, *castanea.*
- b^1. Feathers of back with two black streaks ... ...*meyeri meyeri.*

B.—Basal portion of outer tail feathers grey, not rufous.

- c^1. Feathers of back with two black streaks.
  - d^2. A yellow collar ... ...*xanthospila xanthospila*
  - e^2. A rufous collar ... ... ,, *ruficollis.*
- d^1. Feathers of back with four black streaks ... ... } *darwini darwini.* ,, *joretania.*

FEMALES.

A.—Basal portion of outer tail feathers black or black and rufous.

- a^1. Outer pairs of tail feathers with black markings more or less following contour of feather ... ... *m. macrolopha.*
- b^1. All but outermost pair with black markings more in the nature of bars ... ... *m. biddulphi.*
- c^1. All but outermost pair mostly chestnut on outer and blackish on inner web with whitish tips... *m. nepalensis.*
- d^1. Both webs of all the outer tail feathers mostly chestnut with white tips ... ... *meyeri.*

B.—Basal portion of outer tail feathers grey.

- e^1. Black bars across tail complete ... *x. xanthospila.* *x. ruficollis.*

f^1. Black bars across tail broken into two spots ... ... } *d. darwini.* *d. joretania.*

Of the above, *P. m. macrolopha* and its various sub-species inhabit India from the extreme North-West and the borderland of Baluchistan and Afghanistan to Western Tibet, we then have *meyeri* in Central Tibet through the North of Burmah into Yunnan, next comes *P. x. xanthospila* and its geographical races in Eastern Tibet and Western China, and finally in the extreme East *P. d. darwini* and *joretania.*

If we accept Tibet as being within the geographical range with which we are dealing, the two last are the only ones which do not come within our cognizance.

PUCRASIA MACROLOPHA MACROLOPHA.

The Koklas or Pukras Pheasant.

Satyra macrolopha, Lesson, Dict. Sci. Nat. LIX., p. 196 (1828); id, Traite d'Orn. 494 (1831) Thien Fortpflanz ges Vog, p. 53, pl. xii., fig. 5, (1845-54) (egg.)

Phasianus pucrasse, Gray, in Griff. ed. Cuv., iii., p. 26 (1829).

Phasianus pucrasia, Gray, in Hardw. III, Ind. Zool., p. 40 (1830-32); Gould. Cent. Himal. Birds, pls. 69 and 70 (1832).

Euplocamus pucrasia, Jard. Nat. Lib. Orn., iv., p. 216, pl. xxi. (1834).

Tragopan pucrasia, Temm., Pl. Col. text to No. 545 (pl. 15) (1834).

Phasianus macrolopha, Blyth, Cat. Mus. As. Soc., p. 245 (1849).

Pucrasia macrolopha, Gray, Gen. B., iii., p. 503 (1844); Hutton, J. As. Soc. Beng., xvii., pt. 2, p. 694 (1848); Jardine, Contr. Orn., 1850, p. 145, pl. (eggs); Gould., B. Asia, pl. 26 (1854); Adams, P. Z. S., 1858, p. 500 (Simla); Jerdon, B. of India, iii., p. 524 (1863) (pt. N. W. Himalayan); Tytler, Ibis., 1868, p. 203 (Simla to Mussooree); Pelzeln, Ibis, 1868, p. 321; Beavan, Ibis, 1868, p. 321 (Koteghur); Beavan, bis, 1868, p. 380; Stoliczka, J. As. Soc. Beng., xxxvii, pt. ii., p. 68 (1868); Elliot, Monog. Phas. 1, p. 28 (1872); Brooks, Ibis, 1869, p. 60 (Naini Tal, Almorah); Hume and Marshall, Game B. I. p. 159, pl. ii. (1879), p. 431 (1880) (Himalayah, 3,000-14,000); Marshall, Ibis, 1884, p. 422 (Chamba); Oates in Hume's Nests and Eggs, 2nd ed., iii., p. 411 (1890) (part); Ogilvie-Grant, Cat. Bird B. M., xxii., p. 311 (1893); id Man. Game-Bird, 1, p. 281, pl. xxi. (1895) (Kumaun to Chamba); Blanford, Faun. Brit. Ind. Birds, iv., p. 84 (1898) (part); Oates Man. Game B I., p. 313 (1898); Oates Cat. Eggs Brit. Mus. I, p. 56, (1901); Rattray Jour. B. N. H. S., xvi., p. 663 (1905) (Murree), Nests with Eggs; Ward, ibid, xvii., p. 944 (1907); "Pine Martin," ibid xix., p. 797 (1910).

Pucrasis macrolopha macrolopha, Beebe, Zoologica I. No. 15, p. 279 (1914) (Kumaun and Gahrwal).

Vernacular Names.—Koklas, Kokla (*Simla to Almora*); Pokras (*Bhote Parganas of Kumaun and Garhwal*).

Description—Adult Male.—True coronal crest chestnut fawn; longer lateral tufts and whole head, chin, throat and hind neck black glossed with deep green; sides of the neck with large patch of white; whole upper plumage from neck to upper tail-coverts silver grey, a lanceolate streak down the centre of each feather velvety black, shafts on the lower back and rump paler, and the longer upper tail-coverts more rufous, the longest being almost entirely of this colour, edged with grey and with broken longitudinal lines of black ; central tail feathers rufous, tipped grey and with black shafts, and a line of black on either web running from base to tip along close to the shaft with a fainter similar line close to either edge ; wing coverts like the back, but having the grey replaced by pale rufous brown, shading again into grey on the wing-coverts ; quills brown with broad edges of buff, and the innermost secondaries mottled and blotched with velvety black.

Below from foreneck to vent deep, but bright chestnut, varying considerably in width and extent, but normally covering the greater part of the breast and abdomen ; sides of the lower neck, breast and flanks grey, each feather with a central streak of black and those next the breast with the outer web chestnut ; under tail-coverts chestnut with white spots at the tips ; vent pale chestnut with blackish bases to the feathers, thigh-coverts and adjacent feathers dull buff with mottled black and chestnut webs ; under aspect of tail black with white tips.

Colours of soft parts.—Irides dark brown ; bill dark horny brown or black, the tip always black ; legs plumbeous horny or brown, sometimes tinged with greenish or purplish and at other times almost a fleshy brown or livid-flesh colour.

Measurements.—Wing from 8·5″ (215·9 mm.) to 9·6″ (243·8 mm.) ; the average of nearly 50 birds being 9·3″ (230·8 mm.) ; the tail varies from 8·7″ (220·9 mm.) to 10·9″ (276·3 mm.) ; and averages about 9·7″ (246·4 mm.) ; tarsus about 2·6″ (66·0 mm.) ; bill at front about 1·1″ (27·9 mm.) and from gape about 1·25″ (31·7 mm.). The crest varies greatly, in full-grown birds, being generally between 3·5″ (88·9 mm.) and 4·0″ (101·6 mm.) though it sometimes exceeds the latter a trifle. The spur is short and seldom exceeds half an inch (12·7 mm.) and never three-quarters (19·0 mm.).

Adult Female.—Crown chestnut or buff, with broad black crescentic bars, decreasing towards the end of the short crest, which is also paler than than the rest of the crown ; supercilia pale and broad, though ill-defined, and varying from pale buffish white to creamy buff ; upper parts, including scapulars and wing-coverts pale brown with numerous fine broken bars of blackish, striking pale buff stripes and black centres ; generally the upper back and shorter upper tail-coverts are most richly coloured, the black being bolder and more prominent and the shaft stripes broader and often more rufous than elsewhere ; the longest upper tail-coverts want the bolder marking, and are finely vermiculated with dark brown, and to a less extent with buff, in addition to which they have pale edges ; central tail feathers rufous buff, pale tipped and with irregular bars of black with pale rufous centres; outermost tail feathers chestnut with white tips, black sub-terminal bands and black mottling on either web; intermediate feathers the same, but with comparatively less and less black on each succeeding pair. Chin and throat creamy buff, with a line of black spots running down each side from the angle of the gonys; foreneck and hind neck buff, with broad black or dark brown edges, remainder of lower plumage pale buff to a creamy rufous, each feather with longitudinal markings of dark brown, narrowest on the breast, and broadest on the posterior flanks; under tail-coverts chestnut with white spots; vent and centre of abdomen whitish with drops of dark brown on either web.

The depth of colouring, both above and below and its prevailing tint vary very greatly in individuals from the same locality, some being very much more rufous than others.

Colours of soft parts.—The same as in the male.

Measurements.—Wing from 7·1″ (180·3 mm.) to 8·6″ (218·4 mm.), with an average of 8·15″ (207·0 mm.); tail from 6·8″ (172·7 mm.) to 7·7″ (195·5 mm.), and averaging about 7″ (177·8 mm.); bill at front about 1·0″ (25·4 mm.), and from gape about 1·2″ (30·4 mm.); tarsus about 2·45″ (36·8 mm.).

Hume gives the weight of the male as being from 2-lbs. 2-ozs. to 2-lbs. 14-ozs., and that of the female as 1-lb. 10-ozs. to 2-lbs.

Distribution.—Naini-Tal, Almorah, Garhwal and Tehri-Garhwal, the Simla States Northwards into Lahul. According to Ward the true *macrolopha* is found in Jammu in the South of Kashmir, and it is not until one works further North-West that one comes across *P. m. biddulphi*, but Jammu birds appear to be intermediate, though perhaps nearer *m. macrolopha* than to *m. biddulphi*. Specimens from Murree are also nearer the former than the latter, and it appears that the Common Koklas Pheasant inhabits the extreme South of Kashmir, through Jammu, Naoshera and Punch as far as this town, its place being taken throughout Northern and Central Kashmir by Marshall's Koklas. Probably in the North-West the Jhelum River above where it turns due South forms the Southern boundary, and in the same way the Chenab, where it runs East and West forms its Southern boundary North of Jammu.

Nidification.—Throughout its range the Koklas Pheasant breeds principally between 6,000 and 9,000 feet, sometimes higher up to 12,000 feet, at which altitude Whymper found them breeding freely in Garhwal in the Niti and Nila Valleys, and occasionally lower down, perhaps to some 4,500 feet, but though it may stray even lower than this in the cold weather, more birds will be found breeding over 7,500 feet than below this range.

Rattray has a beautiful photograph of this pheasant's nest which appeared in this Society's Journal, taken by him near

Murree, and in the article accompanying it he recorded it as breeding very commonly in the Galis in the vicinity at between 7,000 and 9,000 feet. In letters to me he describes the nest as being nearly always placed in thick green undergrowth on the sides of hills in forest, either evergreen or fir. Sometimes in amongst bracken in the same forests and sometimes in amongst tangles of briars, raspberries or other canes, but, wherever placed, generally well hidden from the view of the passer-by, and often protected by a fallen tree or some densely foliaged low bush. Occasionally the nest is wedged in amongst the roots of a tree, either standing or fallen, and in such cases may be in a hole or hollow almost out of sight.

Rattray also observes that of the nests he took round about Danga Gali every one was placed under thick bushes of a kind of Rhue with a strong aromatic smell.

The nest itself appears to be a trivial affair of a few leaves, sticks and dead weeds, more often than not merely the accumulation of fallen odds and ends with a receptacle scratched in the centre; less often a more pretentious affair, the materials having been collected together in a heap in the centre of which the eggs lie in a soft, well-lined depression.

The nest may often be found in forests of Paludna Pines, and in these is generally placed in some damp, mossy ravine, in which the rocks, bracken and bush undergrowth offer protection and concealment. It is seldom, if ever, found in the more open parts, where the undergrowth is scanty, and the surface of the hillside unbroken.

Dodsworth found it breeding near Simla amongst Deodars in exactly the same kind of position as that generally found in the Paludna Pine Country, so that undergrowth and possibly the near vicinity of water would appear to be the two essentials in the selection of a nesting site.

The number of eggs laid have been variously reported as being from 4 to 9. Rattray gives the number as 5 to 7, a full clutch nearly always containing the latter number. Hume says 5 to 9; Wilson says that 7 are laid. Whymper has found as many as 7, but says that generally 5-6 are laid. I have had clutches of 4 sent me, which have been much incubated, and have only heard of one clutch of as many as 9.

The most common number in a full clutch thus seems to be 5 to 7, whilst often only 4 are laid, and but rarely 8 or 9.

In general appearance the eggs are more like those of Grouse than those of our true Pheasants. The ground colour is a pale buff, usually rather dull and dirty in tint, sometimes richer and brighter and sometimes with a slight reddish tint. The markings consist of spots, specks and blotches of reddish brown, dark, light or medium in different clutches, and occasionally with a chocolate or purplish tint. I have seen no eggs with secondary or subsidiary markings, though in some cases the spots may be of two tints, one richer and darker, and one paler and more sepia than red-brown in colour; in each case, however, the spots are superficial and not sub-surface.

Variation in the character of the eggs consists almost entirely in the number and size of the markings, and to a slight extent in the depth of their colour. In the majority of eggs the markings are quite small, a few dots and small blotches, but mainly specks and spots, scattered all over the surface of the egg, equally numerously at either end. In some eggs the larger marks are comparatively bigger and more numerous, giving the egg a bolder, brighter look whilst in a few eggs the smaller specks and stipplings are absent or practically so, and, as in these eggs the bolder markings are often of some size, they have quite a handsome appearance.

I have one clutch taken in Garhwal by Mr. S. L. Whymper, in which the markings consist of scanty but rather bold blotches of purple brown, the surface of each spot looking as if mildewed; in these eggs some of the blotches, which consist of very regular round spots, run up to as much as 4mm. in diameter.

The surface of the shell is hard and close, but there is little or no gloss. In shape the normal egg is ordinary "hen's egg" shape sometimes a little compressed and pointed at the smaller end.

Hume gives the dimensions of 50 eggs as averaging 2·08″ (52.8mm.) by 1.47″ (37.3mm.), which is rather larger than the average measurements of those I have had pass through my hands, which are only 51.25 × 37.45. The extremes of length he gives as 1.85″ (47.0mm.) and 2.29″ (58.1mm.) and of breadth as 1.39″ (35.3mm.) and 1.57″ (39·8mm.)

The series I have seen all come within these extremes, with the exception of two eggs which have measured 40.0mm. in breadth, and the eggs of this Pheasant are, on the whole, even more remarkably constant in shape and size than they are in colouration.

The breeding season over the greater part of its range above 7,000 ft. commences in the beginning of May and continues until well on into June. On the other hand, at its lowest level, a few birds may be found laying at the end of April.

The hen-bird is a very close sitter once incubation has commenced, but, unless almost trodden on sneaks away before being discovered as stealthily and silently as a cat. If suddenly disturbed, she goes away with the fluster and noise common to all pheasants under similar circumstances.

It is almost certain that these Pheasants are monogamous, and the cock-bird may generally be found in the close vicinity of where the hen is sitting, and once the chicks are hatched he shares with her the labour of looking after and protecting them.

Hume believed that the Koklas pairs for life, and the observations of modern sportsmen to some extent confirm this. I have repeatedly been told that year after year, if not too much disturbed, the same pair of Pheasants will haunt and breed in some particular small patch of jungle in the same ravine. "Pine Martin" in a very readable article on this bird and the Kalij Pheasant, which appeared in the Bombay Nat. His. Journal, Vol. XIX., does not agree with this. He writes:—

> "In the shooting season the old cocks are almost always "found by themselves . . . In shooting, if your dog puts "up an old cock, do not trouble to look for any more birds "near him."

Incubation takes 20 or 21 days, and the young are able to fly well within a very few days after they emerge from the shell.

General Habits.—The Koklas is normally a bird of high elevation, being found up to 14,000 feet and being most common between 7,000 and 10,000 feet. Wilson says it is found down as low as 4,000 feet, and Hume records it as venturing even lower than this, *viz.*, to 3,000 feet, but to these low hills it only wanders in the cold weather, and then but very rarely. To sportsmen who want to make a bag, it would be little use attempting anything under 5,000 feet and wiser to work at least 2,000 feet above this.

This Pheasant appears to be especially partial to forests of Cypress, Paludna and other Pines, but may also be found in Oak and Rhododendron and Evergreen forests. They prefer broken ground and are often to be found on very precipitous hillsides, so steep indeed as to make it hard work following them; on the other hand, they may sometimes be found in smooth and even country, such as a plateau of a hilltop or the cup lying between two or more. Wherever they may be, however, there must be lots of cover in which to hide, and plenty of undergrowth in addition to the trees themselves. Wilson, or "Mountaineer", undoubtedly the keenest observer-sportsman of the middle of the last century, wrote of this bird:

> "In the lower regions its favourite haunts are in wooded "ravines, but it is found in nearly all hillsides which are "covered with trees and bushes, from the summit of the ridges "to about half-way down. Farther in the interior it is found "scattered in all parts, from near the foot of the hills to the "top, or as far as the forest reaches, seeming most partial to "the deep sloping forest composed of oak, chestnut and "Morinda Pine, with box, yew and other trees intermingled, "and a thick undergrowth of Ringall."

As a sporting bird the Koklas ranks very high, and even now few will be found to dispute Hume's dictum that of all the Hill Pheasants "the Koklas is the best eating and affords the best sport."

One cannot get bags of 20 and 30 couple as one can of the Junglefowl and the Kalij Pheasants, but there can be no denying the fact that in sporting appearance the latter birds cannot compete with the Koklas, handsome though they may be in their own way.

The following account of a Koklas shoot written by a friend who desires to remain anonymous gives a good description of the bird, its haunts and the sport it gives under favourable circumstances. He writes :—

> "R., an old hand at the game, who has worked Murree and "its Galis, both ornithologically and oologically for many "years with great success, had put me up to all the ropes "about the Koklas before I paid my visit to the Hills, so that "A. and I came up to this giddy whirlpool of Indian Society "determined to have at least a couple of days' shoot before we "went down again to perspire in the Plains. Our first day's "shoot was not a success, as we only had three shots and "got but one bird, so I will not descant on it here. The "second time out, however, we were much more successful— "shot between us a dozen birds, which I think may be considered a good bag nowadays anywhere close to the better "known Galis.
>
> "It was getting late in February, but the cocks had not "started crowing as regularly and as often in the morning as "is their wont later on in the season, but our '*Shikari*' "Jowala, had marked down for us at least half a dozen places "in which he had seen or heard cocks crowing and half a dozen "more in which he *thought* there were birds.
>
> "Starting as soon as we could see our way from the rest-"bungalow, we were soon at the first spot where he hoped to "pick up a bird, and where indeed the previous evening we "had ourselves heard the ringing 'pok-pok-pokras' crow of "an old cock as he retired to rest.
>
> "We had three good dogs with us, half-bred cockers, two "of which had been lent to us by a man who had shot over "them in the country we proposed to shoot, and as soon as we "arrived in good positions we sent the dogs in. The ravine "was a deep and very broken one, covered with rather thinly "scattered oak and other trees, but with lots of bracken and "other undergrowth, and with banks rising rather steeply to "some 2 or 3 hundred feet on either side. Starting at the "lowest end of the ravine A. took one side and I the other, "working along about 50 yards apart, and some 20 yards up "the hillside from the bottom of the ravine. We were very "soon on to some birds, and could hear them scuttling through "the dry undergrowth in front of one of the cockers before,

"with a whirr of wings, first one and then two other birds got "up, rocketed up into the air, and, turning, flew down towards "us at a tremendous pace. A. had his bird down with a "ripping shot, but I'm sorry to say I tinkered my first bird "badly, though I somewhat retrieved the first shot with my "second as I managed to swing round and get the other bird "just as she disappeared from sight. As I fired at this, a "fourth bird got up, but, frightened by our shots, went uphill "and settled again within 100 yards, for though we could not "see her, we heard her go down.

"Picking up our two birds we went on up the ravine, but "though the dog feathered constantly we came on no other "bird until we had gone some distance, when we picked up "the scent of the fourth bird, which, on alighting, had evidently "scurried off uphill on foot as fast as she could. The dogs "were after her, however, hot foot, and just as they reached "the crest of the hill, up flew the bird and hurtled down over "our heads, but out of shot. We had not, however, done with "the ravine, for as we got nearly up to the higher end the dogs "shewed there was more business afoot, and after a few "minutes' work amongst the rocks, which here were large and "numerous, drove out another two birds, one of which found "its way within a straight shot from my gun, and the other of "which escaped A. in between the treetops out of sight of "where he was standing.

"Leaving the ravine, we proceeded to our next beat, this "time a hillside covered with the same forest as that we had "left, but with the ground much more precipitous and very "rocky. According to our guide, the birds were probably "about half-way up the hill, so we made our plans accordingly. "With dogs the *probability* was that the birds would rise "quickly and fly straight down, without dogs the *certainty* "would have been that the birds would have run uphill until "they had topped the crest. We, therefore, worked round the "lower part of the hill, A. taking the bottom and I keeping "about 100 feet above him, whilst Jowala and one of the dogs "started in about the same distance above me. We had nearly finished the hill, and I had given up all hope of any bird, "when without any notice from the dogs who had worked "well up the hill after *something* for nearly 200 yards back, five "birds got up together, and came spinning down past us, giving us beautiful shots within easy range. In my eagerness, "however, I stepped forward too quickly on a rolling stone, "and sitting down with a most emphatic bump emptied both "barrels into the air without a feather falling in response "thereto. A., more fortunate, kept both head and feet, and "bowled over a nice right and left, but missed one of two "other birds which got up almost immediately a little further "on. Just beyond the brow of this hill we put up yet another "bird, evidently one of the same flock, but failed to get a shot "on account of the trees.

"The next beat in which Koklas had been marked down for "us was some distance away from the hill just shot over, but "there were one or two likely places *en route* and beating "through these, we picked up a brace of Hill Partridge and "A. also bagged a cock out of some oak bushes from which the "spaniels flushed her. This, by the way, was the only Wood-"cock we saw all day on this occasion, though they are not "uncommon, and indeed breed in the Galis.

"Our third beat was a very long ravine running round the "side of a hill, the steep hillside rising high above it on one "side, whilst on the lower there was only a high bank, perhaps "30 or 40 feet higher than the centre of the ravine. A toss "of a coin gave A. the choice of places, and he selected the "side of the ravine next the hillside, whilst I took the lower. "Immediately the dogs were let go, they shewed that birds "had been on the ground, and feathering briskly, they work-"ed up the hill after them.

"They had moved on again, however, and nothing resulted "for the time being, but about 200 yards further on it was "evident that one of the dogs was close on to them, and pre-"sently up they got, first a pair which proved to be an old "cock and hen flustered up directly in front of A., and were "neatly disposed of, and within a few seconds another three "birds got up one after another from amongst which A. and "I each managed to bowl over one and miss another. A good "long tramp followed this with nothing to show except a "Pigeon which I got as it flew overhead. It was fast getting "hot, for even at 7,000 feet and more it can get very hot "tramping a difficult hillside, so we called a halt and had lunch "and a pipe, whilst we rested for an hour or so. Shortly after "resuming we got into a very pretty bit of country; the ravine "through which we were working widened out into an open "hollow nearly 100 yards across in which the scattered oak-"trees grew amongst dense bracken in a way which reminded "us very much of an oak copse on some of the Welsh Hills. "Evidently we were both taken up too much with the pic-"turesque side of nature, for when two birds got up within easy "shot of me, I managed to miss both, whilst two shots fired by "A. in an attempt to wipe my eye were no more effective.

"From this ravine Jowala took us to a wide natural hollow "between three peaks, which shut it in on three sides, the "fourth side just rising gently for a few yards, and then "dipping down again into a valley far below. The centre and "fourth side of the hollow were practically free of all cover "except a few scattered bushes and Jowala informed us that "any birds which might be within working distance would "certainly fly straight down to the hollow and then out by the "open fourth side into the valley below. There was no special "choice of stands, so A. took up one side of the gap and I the "other, both making use of a thick bush to screen us from the "hillside. Putting in the dogs we worked one of the small "peaks without any result, though a Barking-Deer was put "up which fled uphill, barking loudly as he went. Calling "the dogs back, we then sent them into the cover on the "second peak, and in this soon had some Pheasants put up, "but these birds evidently thought it too hot to face the open, "and merely flew into the nearest trees so that it was not "until Jowala, guided by the yapping of the spaniels, came "to their assistance, that the birds left. First came an old "cock with wings almost closed as he got way on and came "down towards us at express speed, so fast was he that A. "was behind him with his first barrel, and only winged him "with his second. Down he came, with a thud on the ground "and feathers flying in all directions, but as soon as he "touched the ground he was up and off like greased lightning "into the nearest cover. We had no time, however, for the "moment to spare retrieving him, for A.'s shots had started "the rest of the covey, and down they came too. On starting "they beat their wings with great rapidity, continuing to "rise in the air, but as soon as they had got to what they considered the right height and had got fairly going, they half "spread their wings out and swept down upon us at a pace "that deceived me, although I had just seen A. miss. The "consequence was I was behind with both barrels, and had "the mortification of seeing five birds sail over the edge into "the valley below with never a feather rumpled.

"The third peak yet remained to be worked, and from this "the dogs turned out three birds, who took to trees just as the "last lot had done, and, like them, when turned out by "Jowala came straight down for the opening into the valley "below.

"Determined to give them enough law this time, I pitched "forward a good three yards ahead of the leading bird, and had "the pleasure of seeing him turn turtle in the air, and before "he touched Mother Earth had his wife falling with him. "A. also managed to get another bird, and we then sent 'the dogs after the runner, which they failed to recover.

"Doubtless he had treed, and they were thus beaten. We "could hear them following up his trail right far down into "the *khud* below, but it was miles round had we tried to get "there ourselves, so reluctantly we had to give him up.

"We noticed, as we had been told would be the case, that "the birds always tried to run uphill, but when once flushed, "they rose fairly straight up into the air, making a tremen-"dous commotion with their wings until high enough to clear "the denser vegetation. Once up as high as this, they turned "and came downhill towards us, and over the dogs, either "sailing down with half-spread wings, or, especially when it "was nearly level alternately sailing and rapidly beating their "wings. When they pitched over a steep place, they nearly "closed their wings, and the pace they came at was very "great, and this combined with the fact that often one only "got the quickest of snap-shots at them made the shooting "very difficult, much harder, we both thought, than taking "rocketing pheasants out of a home covert.

"Most of the birds when put up by the dogs made a noise "which reminded us of the Common Pheasants' crow under "similar circumstances, but it was not as loud and might be "described as a harsh chuckling protest at being disturbed. "The crow, which is indulged in morning and evening, is a "fine ringing call, quite characteristic of a true game-bird."

It is said that the Koklas will crow in response to a clap of thunder or any other sudden loud noise, such as the fall of a rock or tree, or the firing of a gun.

At one time round about Naini Tal the Koklas was a comparatively common bird, and Mr. S. L. Whymper tells me that he has shot as many as eight birds before breakfast on "Cheena." They have, however. been much shot at there as elsewhere, and are certainly much less common now in all the easily got at places than they were twenty-five years ago

In epistola Mr. Whymper says:—

"The open places in the forests (Oak and Rhododendron "principally) were their favourite haunts in the mornings "and evenings, and they were to be found day after day at "the same time in the same place, a trait which, of course, "leads to their easy destruction.

"The Koklas when young is, I think, the best of all the "Indian Pheasants for the table, and is certainly the best for "sport, rising very rapidly and flying with immense velocity.

"A very curious thing in connection with these Pheasants "is that I have twice known of their being found fast asleep "(almost as if drugged) on paths. I once myself caught in "this manner a full-grown young cock, and an old sportsman "in Naini Tal told me that he also was aware of similar "instances.

"I once had the pleasure of seeing a hen Koklas knocked "over in full flight by a *Spizætus nepalensis*, the Crested Eagle; "I ran up and caught her, and after a short while let her go, "when she ran off as if nothing had happened."

The Koklas feeds on all kinds of grain, grass seeds, acorns, berries and buds, and also upon insects, worms, etc., though it is probably more of a vegetarian than insectivorous feeder on the whole. Mr. Wilson says that it feeds principally on leaves and buds, and that owing to its disinclination to a restricted diet of grain, is harder to rear in capacity than either the Cheer or Monal.

PUCRASIA MACROLOPHA BIDDULPHI.

The Kashmir Koklas.

Pucrasia macrolopha.—Adams, (nec. Less.) P. Z. S. 1859, p. 186 (Cashmere); Oates in Hume's N. and E, 2nd ed. iii, p. 411 (1890) (part, Cashmere); Blanf. Faun. Brit. Ind., iv., p. 84 (1898) (part, Cashmere); Magrath, Jour. B. N. H. S., xviii, p. 298 (1908) (Thandiani).

Pucrasia biddulphi.—Marshall, Ibis, 1879, p. 461; Id. J. F. O., 1879, p. 424; Id. Str. Feath., viii, p. 445 (1879); Oates, Man. Game-B. I., i, p. 318 (1898).

Pucrasia macrolopha biddulphi.—Ogilvie-Grant, Cat. Birds B. M., xxii, p. 313 (1893) (Cashmere and Gilgit), id. Man. Game-B., i, p. 284 (1895); Beebe, Zoologica 1, No. 15, pp. 273-279 (1914); Ward, J. Bomb. N. H. Soc., xvii, p. 944 (1907) (Cashmere and Jammu).

Vernacular Names.—Plas, (*Kashmir*); Kukrola, (*Chamba*).

Description—Adult Male.—Differs from true *P. m. macrolopha* in being slightly darker above and in having the chestnut on the foreneck extended to the hindneck. Below, the chestnut is much darker and more mixed with black, whilst the feathers of the upper breast often have very narrow margin of black, which give this part of the plumage a still darker appearance.

Colours of the soft parts.—As in *P. m. macrolopha.*

Measurements.—I have been able to examine only a small series of this form of Koklas, but the average dimensions work out to much the same as in the Common Koklas.

The type (British Museum) has a wing of 9·2″ (233·6 mm.) with a rather short tail of only 9″ (228·6 mm.), but another specimen from Kashmir has a tail of 9·8″ (249·0 mm.) and doubtless a big series would show as great a range of variation as does *P. m. macrolopha.*

Adult Female.—As a rule, the females of the Common Koklas have the outer tail feathers much mixed rufous and black, but the general trend of the marking is to follow the contour of the feather so that it is longitudinal in character. In the Kashmir bird the black generally forms bars except on the outermost pair. The bars are comparatively well-defined on the terminal half of the feathers, and also form a well-marked, broad sub-terminal band.

Colours of the soft parts.—As in *P. m. macrolopha.*

Measurements.—About the same as in *P. m. macrolopha.*

Distribution.—Northern Kashmir from Ladak to the extreme West, where the Indus probably forms its Western Boundary, where this River runs due North and South. Where, however, the Indus runs East and West, it does not form the Northern Boundary for the birds from Gilgit, the Gangri Range North of Leh and Northern Ladak are all quite typical *biddulphi.*

Where this form meets *castanea* is an undecided question, and sportsmen shooting on the N.-E. Frontier have still to settle it so that they should remember that any skins, of males especially, are very badly wanted from practically anywhere in the N.-W. Frontier Provinces.

Nidification.—This Pheasant breeds in Ladak at elevations between 7,000 and 10,000 feet, and its nest and eggs have been taken there by Col. A. E. Ward and his collectors on several occasions. Nests have also been taken by different collectors, north of Srinagar, and Mr. Davidson remarked that he found it common above Gund, but apparently failed to obtain the nest.

Like the Common Koklas, the Kashmir bird nests in forests, often of pine or fir, and lays its eggs in a collection of leaves and rubbish under the protection of a thick bush, tree or bank; sometimes under a boulder or projecting rock. The nest itself may be either a mere heap of wind-blown leaves and grass, gathered together in some partially sheltered corner or a mass of similar material scraped together by the bird itself.

The number of eggs laid appears to vary from 4 to 9, 5 or 6 being the more often found.

I have but two clutches of eggs of this form of Koklas. These in appearance cannot, of course, be distinguished from many of those of its more southern cousin. One clutch of 6 and one clutch of 4 contain eggs varying in size from 49·8 × 36·2 mm. to one 51·4 × 36·3 mm., and another 50·4 × 38·2 mm.

The breeding season seems to commence in the end of May and last through June into the middle of July.

General Habits.—The Kashmir Koklas inhabits much the same kind of country as does the Common Koklas, but would not seem ever to descend below some 5,000 feet, and not often as low as this. It is curious, therefore, that its general plumage should be darker than that of the latter bird and evidently in this sub-species elevation and humidity are not the dominant factors in producing depth of colouring, a course of reasoning which is emphasised when we find that the Chitral bird, of still more arid clime is darker and redder yet.

It is possible, however, that the depth of colouring may be in some measure protective, the darker bird being less conspicuous when lying hid in the deeply-shaded gorges and ravines which it frequents. It keeps much to the Pine and Fir forests, but is also to be met with in Oak, Rhododendron and other kinds as well, but wherever it is found the country is nearly always precipitous and rocky, and where the hills are more or less rounded the birds betake themselves to the steeper places in between them and eschew their smoother summits and easier gradients.

Like other members of the genus, this Koklas keeps very close to the same ground, and may be found morning after morning and evening after evening haunting the same open glade in its search for food, which consists as usual of a mixed vegetarian and insect diet.

In flight, voice and general habits there is nothing to distinguish this bird from the last.

PUCRASIA MACROLOPHA NIPALENSIS.

The Nepal Koklas.

Pucrasia macrolopha, Jerdon (nec. Less.) ; Jerdon B. of India, iii., p. 524 (1863) (part, Nepal).

Pucrasia nipalensis, Gould. P. Z. S., 1854, p. 100 (Nepal, Bootan) ; Gould. B. of Asia, vii. pl. 28 (1854) ; Hume, Str. Feath. vii., p. 428 (1878) ; Hume and Marshall, Game B. 1, p. 165 pl. (1878) ; Marshall, Ibis 1879, p. 463 (Bootan) ; Scully, Str. Feath viii., p. 343 (1879) (W. Nepal) ; Hume, ibid, p. 449 (1879) ; Oates, Hume's Nests and Eggs, iii., p. 411 in (1890) (part) ; Blanf. Faun. Brit. Ind., iv., p. 84 (1898) (part) ; Ogilvie-Grant, Cat. Birds B. M., xxii., p. 314 (1893) (Nepal) ; id. Man. Game B. 1 p. 284 (1895) (W. Nepal) ; Oates, Man. Game B. 1, p. 320 (1898) (Nepal).

Pucrasia duvauceli, Bonap. Comp. Rend., xliii., p. 879 (1856) ; Elliot, Monog. Phas., 1, pl. 28 (1872) id. Ibis 1878, p. 125.

Pucrasia duvauceli.—Hume Str. Feath. v., p. 138 (1877) id. vii., p. 124 (1878).

Pucrasia macrolopha nipalensis, Beebe, Zoologica 1, No. 15, p. 278 (1914).

Vernacular Names.—Pocrass, (*Nepal*).

Description—Adult Male. - Differs from *P. m. biddulphi,* and to an even greater extent from *P. m. macrolopha* in being everywhere much darker both above and below ; the black centres to the feathers occupy practically the whole of both webs, leaving only a narrow edging of pale buff or whitish. The chestnut colouring on the foreneck also extends right round the neck, and on to the shoulders, the feathers here, of course, having black centres as in true *P. m. macrolopha.* On the breast and abdomen the black runs even on to the centre of these parts, though varying much in extent in different individuals.

Colours of soft parts. –As in *P. m. macrolopha.*

Measurements. –The Nepal Koklas is a decidedly smaller bird than either the Common or Kashmir form. The wing runs from

8·3″ (210·8 mm.) to 9″ (228·6 mm.), with an average of only 8·6″ (218·4 mm.); tarsus about 2·6″ (66·0 mm.); crest from 2·7″ (68·5 mm.) to 3·6″ (91·4 mm.).

Nearly every specimen I have been able to examine has the tail broken or incomplete, so that the measurements are valueless.

Adult Female.—Similar to the others of this species, but as a rule all except the outermost pair of tail feathers are chestnut on the outer web, blackish on the inner with white tips, and a well-marked subterminal black band. The female Nepal Koklas also often has a more decided tint of rufous on the hind-neck and outer scapulars.

Colours of soft parts. --As in the Common Koklas.

Measurements.—Wing about 8·2″ (208·2″ mm.). Crest in the few I have been able to examine, very short and thin, generally under 1·5″ (38·1 mm.)

Distribution.—Beyond the fact that this Pheasant is found in parts of Western Nepal, we really know nothing about its distribution. The only specimens known are those got by Scully and Hodgson for Hume from natives, so that their exact localities are still unrecorded. Hume and Captain Marshall both speak of Bhutan as being included in their range, but there is nothing to shew on what grounds these statements are made, and there has been nothing since ascertained to confirm them. At the same time, it is possible, nay, extremely probable, that it will be found to range from West and East Nepal and through Sikkim and Bhutan until it meets *meyeri* or some hitherto undescribed from linking it with that bird.

Nidification.—Not known.

General Habits.—Of this Pheasant, Scully writes :

> " In the beginning of 1877, Mr. Hume urged me to procure ' specimens of the Nepal Koklas, in order that the question of " its identity with, or distinction from *macrolopha*, might be " definitely settled. This proved no easy task, as the bird, " though not uncommon in the Western portion of the Nepal " Himalaya, does not occur in any part of the hills so far East " as the Valley of Nepal. However, after waiting for some " six or seven months, I received the seven birds whose measurements are recorded further on, from Jumla in Western " Nepal. Three other specimens were subsequently seen in " confinement in the valley, and these also had been brought " from Jumla."
>
> " Unfortunately I can give no details about the habits of " this Pheasant from personal observations ; it is said to be " plentiful about Jumla, where it is found not far from the " snows. In confinement the birds become very tame, and " seem to prefer green leaves and shoots, etc., to grain for food. "

PUCRASIA MACROLOPHA CASTANEA.

The Chestnut-Mantled Koklas.

Pucrasia castanea, Gould., P. Z. S., 1854, p. 99 (Kafiristan); id, B. of Asia, vii., pl. 27 (1854); Hume Str. Feath., v., p. 138 (1877); Elliot, Ibis 1878, p. 125; Ogilvie-Grant, Cat. Birds B. M. xxii., p. 314 (1893) (N. Afghanistan and Kafiristan); id, Man. Game B. 1, p. 285 (1895); Oates, Game B. 1, p. 312 (1898).

Pucrasia duvauceli, Marshall (nec. Bonap.) Ibis 1879, p. 463 (N. Afghanistan).

Pucrasia macrolopha var *castanea,* Fulton, Jour. B. N. H. S., xvi., p. 61 (1904) (Chitral).

Pucrasia macrolopha, Perreau, Jour., B. N. H. S., xix., p. 919 (1910) (Chitral).

Vernacular Names.—None recorded.

Description—Adult Male.—Differs from *P. m. macrolopha* in having the chestnut on the foreneck extending to the hindneck and mantle; the rump is more weakly marked with black and the chestnut of the throat runs further up into the chin. Practically the whole of the breast and abdomen are chestnut, darker than in true *macrolopha* and marked with black, especially on the flanks. The white marking on the breast and flanks of *macrolopha* are in this form confined to a few narrow margins on some of the feathers at the sides of the breast.

Colours of soft parts.—Not recorded.

Measurements.—Wing about 9·5″ (241·3mm.); tail about 7·0″ (177·8 mm.); tarsus about 2·7″ 43·2 mm.); spur about 0·4″ (10·1 mm.); bill at front about 1″ (25·4 mm.) and from gape about 1·2″ (30·5 mm.); crest up to 4·1″ (104·1 mm.).

The Female of this Pheasant is still unknown.

Distribution.—The ranges of mountains of Afghanistan, Kafiristan and Chitral, where they border on the North-West Provinces.

The limits of the habitat of this sub-species and where it meets *P. m. biddulphi* are at present unknown. At Gilgit, as already noted, *biddulphi* is the sub-species obtained, though the birds here do, to some slight extent, approach the Chitral bird.

Fulton and Perreau both record the bird as common in Chitral, and doubtless it will be found to be so throughout these hills in suitable localities from N. of the Kabul River in Kafiristan to Wakkan or even further North and East.

Nidification.—Unknown.

General Habits.—There is so far nothing on record except Fulton's interesting remarks in this Journal. He writes:

> " This fine Pheasant is common on some of the heavily " timbered mountain-side of Lower Chitral, *viz.*, Pattison, " Asreth, and the valley behind Drosh Fort.

"It is generally found above 7,000 feet, but ranges lower "in winter. Specimens are very difficult to obtain owing to "the dense nature of the ground they keep to. There are "probably large numbers of them in Dir and Kafiristan. At "the head of the Pattison Valley their harsh cry can be con-"tinually heard in spring. It is also to be heard in the "Asreth Valley. It is the call of the male that has led to the "belief that the Jungle-Fowl (*Gallus ferrugineus*) is to be found "in the country. I made a special point of trying, if possi-"ble, to find the "Jungle-Fowl and have no doubt that none "exist. All the camps at which the cry of the Jungle-Fowl is "said to have been heard, are far above the limit of elevations "to which they are known to extend. It can easily be under-"stood that the cry kok-kok-kok—kokras, or the plain kokras "has been mistaken for that of the Jungle-Fowl when heard "at any distance. When, however, the call is once heard "near at hand, it cannot be possibly confounded with that of "*Gallus ferrugineus*."

PUCRASIA MEYERI.

Meyer's Koklas.

Pucrasia meyeri, Madarasz, Ibis, 1866, p. 145; Ogilvie-Grant, Cat. B. M. xxii, p. 314 (1893), id, Hand-Book Game B. 1, p. 285 (1895).

Pucrasia xanthospila meyeri, Beebe, Zoologica, 1, No. 15, p. 182 (1914).

Vernacular Names.—None recorded.

Description—Adult Male.—Has the upper plumage similar to that of *xanthospila*, with the same single central streak of black on each feather, but the tail is similar to that of *macrolopha*. It is said by Madarasz to differ from the former bird in having the centre of the breast and abdomen a more vivid chestnut; the central tail feathers fulvous with black striations, the lateral tail feathers rufescent with white tips, and black sub-terminal bands.

Colours of soft parts and measurements.—As in *macrolopha*; with more material it will probably be found that in measurements *meyeri* will come between *macrolopha* and *xanthospila*, the latter being a decidedly smaller bird than the former.

Adult Female. "Differs from the female of *xanthospila* in "having the middle tail feathers fulvous vermiculated with "black, and the outer tail feathers rufous, black towards the "apex and tipped with white." (Ogilvie-Grant.)

From the female of *macrolopha*, with which the female *meyeri* may be more reasonably compared, it differs in having both webs of all the outer tail-coverts chestnut-rufous with white tips and broad, well-defined sub-terminal black bands.

Colours of soft parts.—As in *macrolopha*.

Measurements—Wing, 8·5″ (215·9 mm.); tail in moult, 6·9″ (175·2 mm.); tarsus 2·45″ (62·2 mm.); bill at front about ·9″ (22·8 mm.) and from gape about 1″ (25·4 mm.); crest 1·45″ (36·8 mm.)

Distribution.—" Yerkalo, Upper Mekong to Central Thibet." (Ogilvie-Grant.)

The actual distribution of this Pheasant is really not known. Certain specimens were obtained in Yerkalo and *somewhere* in Central Thibet, and it has been also obtained on the Upper Mekong River in Yunnan, how far it extends North and East of this is quite unknown.

Nidification and General Habits.—Nothing recorded.

PUCRASIA XANTHOSPILA XANTHOSPILA.

The Yellow-necked Koklas.

Pucrasia xanthospila, Gray, P. Z. S. (1864), p. 529, pl. xx, Saurin, ibid, 1866, p. 437; Gould., B. of Asia, vii., pl. 24 (1869); Gray, Hand-L. of B. ii, p. 259 (1870); Swinh. P.Z.S., 1871, p. 399; id, ibid, 1872, p. 550; Elliot, Mon. Phas. 1, pl. 30 (1872); Sclater, Ibis, 1874, p. 169; Dav. and Ous. Ois, Chine, p. 407, pl. 104 (1877); Seebohm, Ibis, 1891, p. 380; Ogilvie-Grant, Cat. B. M. xxii., p. 315 (1893); id, Hand-Book, Game B. 1, p. 285, 1895.

Pucrasia xanthospila xanthospila. Beebe, Zoologica, 1, No. 15, p. 281 (1914).

Vernacular Names.—Song-ky (*Chinese*).

Description, Adult Male.—Differs from *macrolopha* in having a golden-buff nuchal collar extending from the chestnut foreneck round the hind neck and into the extreme upper back. The feather pattern of the upper plumage, though somewhat like in general character, is quite different in detail. The feathers of the back and upper parts have mottled grey and black centres, next a broad longitudinal line of black and finally grey edges; the upper tail-coverts have broad grey centres, next following the contour of the feathers consecutively lines of black, chestnut, black and finally grey. The tail feathers are grey with white tips and three broad bands of black. Below, this Pheasant is superficially much like *macrolopha*, but again the distribution of the colours on the feathers is different, the grey and black being arranged in the same sequence and manner as on the feathers of the upper plumage.

Colours of soft parts.—Apparently these do not differ from *macrolopha.*

Measurements.—Wing about 8·35″ (212·1mm.); tail from 8″ to 9″ (203·2 to 228·6 mm.); tarsus 2·4″ (60·9 mm.) to 2·6″ (66·0 mm.); bill at front about ·95″ (24·1mm.), and from gape about 1·1″ (27·9 mm.): the spur seems to run very small in this species, in several it merely consists of a blunt knob and in none does it reach

·5″ (12·7 mm.) in length. The crest varies from 3·1″ (78·7 mm.) to 3·7″ (93·9 mm.) in length.

Adult Female.—The females of *xanthospila xanthospila* and of *xanthospila ruficollis* differ from the females of *macrolopha* and its sub-species in having the chestnut of the outer tail feathers replaced by grey marked with black, these colours being generally in well-defined cross bands.

Colours of soft parts. As in *macrolopha.*

Measurements.—Wing about 7·9″ (200·6 mm.); tail about 6·5″ (165·1 mm.) to 7·1″ (180·3 mm.); tarsus 2·35″ (59·6 mm.) to 2·5″ (63·5 mm.); bill at front about ·9″ (22·8 mm.), and from gape about 1″ (25·4 mm.); crest from 1·2″ (30·4 mm.) to 1·4″ (35·5 mm.)

Distribution.—"Mountain forests of North-Western China, extending into Manchuria and Eastern Tibet." (Ogilvie-Grant.)

The types of this species were obtained in the Mountains North-West of Pekin, and very far from our Indian limits, but it has also been obtained at Tachien-Lu, just within the borders of extreme Eastern Tibet.

Nidification.—Nothing recorded.

General Habits.—This Pheasant is fairly common in the Pine Forests on the more rugged mountains of North-West China as far West as the Yun-Ling Mountains in Eastern Tibet, where it seems to have similar habits to those of our Indian bird.

According to Père David, their habits are much like those of the true Pheasants; they are said never to stray far from thick cover, either of the Pine Trees or undergrowth, where they are to be found either singly or in pairs, feeding on grain and other vegetarian diet, and especially upon conifers. They are said to be excellent eating, and much superior in this respect to the other kinds of Pheasant found in the same parts of China.

Genus *CHRYSOLOPHUS.*

The genus *Chrysolophus* contains only two species, one the well-known Golden Pheasant, the other the Amherst Pheasant which just enters our limits in the extreme East.

The distinguishing feature of the male is the curious cape-like arrangement of feathers arising from the nape and hanging over the neck and extreme upper back. There is also a true crest of hairy feathers.

The tail is composed of 18 feathers, and is of very great length, the central pair being four times as long as the outermost. The wing quills are graduated, the fifth being the longest, and the first the shortest, being shorter than the tenth. The tarsi are long and stout, and armed with a spur in the male.

CHRYSOLOPHUS AMHERSTIÆ.

Phasianus amherstiæ, Leadbeater, Trans. Linn. Soc., xvi., p. 129, pl. 15 (1828); Blyth. Cat. Mus. As. Soc., p. 246 (1849).

Thaumalea amherstiæ, Wagler, Isis, 1832, p. 1228; Gray, Genera Birds, iii., p. 497, pl. cxxv (1845); Sclater, List Phas., p. 5, pl. 3 (1863); Swinh., P. Z. S., 1863, p. 307.

Gould., B. Asia, vii., pl. 20 (1866); Sclater, P.Z.S., 1870, pp. 128 and 670 (Yun-ling Mts.); Id, Ibis, 1870, p. 297 (Tachienlu); Swinhoe, P.Z.S., 1870 p. 111; Elliot, Monog. Phas., ii., p. xx., pl. xiv. (1872); Sclater, Ibis, 1874 p. 169; David and Oustalet, Ois. Chine, p. 415, pl. 103 (1877); (W. Sze chuen, Yunnan, Quei-chow, E. Tibet); Anders., W. Yunnan, p, 671 (1878), (Yunnan Frontier); Seeb., Ibis, 1891, p. 380 (W. Sze-chuen); Bailey, Journ. B. N. H. S., xxii., p. 367 (1913) (Tachienlu).

Chrysolophus amherstiæ, Gray, List. Gallinæ Brit. Mus., p. 30 (1867); Swinh., P.Z.S., 1871, p. 398; Ogilvie-Grant, Cat. Birds B. M., xxii., p. 342 (1893); id Hand-L. Game B., ii., p. 46 (1896); Seth-Smith, Avicult. Mag., iv., p. 142 (1898); Oates, Man. Game B., ii., p. 497 (1899) (Myitkyna); Ogilvie-Grant, Ibis, 1900, p. 606 (Chen-chi); Davies, Ibis, 1901, p. 408 (W. Yunnan and Kweichow); Oates, Cat. Eggs, B. M., 1, p. 59, pl. vi., fig. 6 (1901); Finn., Avicult. Mag. (new ser.) iii., p. 102 (1905); Comber, Journ. B. N. H. S., xvi, pp. 512, 530 and 753 (Sadon 9,000 ft.) Harington, Journ. B. N. H. S., xix., p. 309 (1909).

Vernacular Names.—Ja (*Tibetan*): Sen-chi (*Chinese*); ? Woo-chree (*Burmese, Shan States*).

Description.—Adult Male.—Occipital crest of hair-like feathers, blood crimson; feathers from the back of the head and behind the ear-coverts falling in a broad cape over the back scapulars and shoulders of the wing, pure white with edges of velvety black, glossed with steel blue, and the longest with a second bar of the same about $\frac{3}{4}''$ from the tip; remainder of head, neck, throat, upper breast and mantle brilliant peacock green, the feathers of the breast and mantle sub-bordered with black and with tiny scintillating edges of emerald green; lower back and rump brilliant golden buff, each feather with a broad band of metallic dark blue-green, which shows up here and there, and with a hidden black base; upper tail-coverts black and white, the central and some of the lateral ones with flame-coloured tips; the longest tail-coverts fall in pairs on either side of the true tail feathers, making them look as if tasselled with orange gold. Central tail feathers white with bars of metallic blue-black, and with irregular broken bars of dead black, more or less at right angles to those on the white interspaces; outer tail feathers mottled black and white on the inner webs, white on the outer webs with regular bars of blue-black, and with broken black edges; the white next the edge changes to a dull buff-brown.

Wings: primaries brown, the outer edges white over all but the last inch cr so, outer secondaries brown, the outermost only edged with white; inner secondaries, coverts and whole visible portion of wing deep steel-blue, each feather edged with velvet black.

Below, lower breast, abdomen and flanks white; anterior flanks, thigh-coverts and vent white with black bars and mottlings; under tail-coverts deep blue-green with black edges.

A very bright-coloured male from Moupin has the feathers of the throat, chin, foreneck, and upper breast with white centres, conspicuous on the throat and foreneck, but concealed on the upper breast. One or two other specimens have these same white centres, but in a much smaller degree, and in none are they visible unless the feathers are lifted so as to expose their basal portions.

Colour of soft parts.—"Iris clear yellow" (Pére David.) Orbital skin blue, varying in brightness and depth of colour according to season; bill yellowish horny, darker at base and round nostrils; legs and feet plumbeous or bluish horny, toes and claws darker. Iris bright straw-yellow.

Measurements.—"Total length about 60 inches; wing 8·2; tail 30; tarsus 3·1." (Ogilvie-Grant.)

The series in the British Museum have wings running from 8·1″ to 9·2″ (205 to 233 mm.); tails from 34″ to 45″ (863 to 1,143 mm.); bill at front about 1·05″ (26 mm.); tarsus from 3″ (76·2 mm.) to 3·4″ (86·3 mm.); spur a mere knob, never as much as half an inch (13 mm.); the crest is generally about 2″ (50·8 mm.), and in the longest only measures 2·4″ (61 mm.).

Adult Female.—Forehead and feathers over the eye rufous, more or less tipped black; feathers of crown and nape and sides of neck barred black and rufous-buff with a sheen, strongest on the hind neck, of steel-blue; whole upper plumage barred buff and dark-brown, the buff bars to the feathers of the mantle more rufous, with the edges mottled with black and buff, the black mottling extending to the lower bars on the rump, lower back and upper tail-coverts; primaries and outer secondaries brownish black, barred with rufous buff; inner secondaries like the wing-coverts.

Chin and throat albescent and generally immaculate or nearly so, sides of throat, neck and breast chestnut-buff paling to creamy-buff on the flanks, narrowly edged with black and with broad semi-concealed bars of black; centre of breast and abdomen paler creamy, unmarked; under tail-coverts barred dull rufous-buff and black.

Colours of soft parts.—"Iris yellow" (Wingate.)

Orbital skin dull blue; bill yellowish or greenish horny, darker at base and on culmen; legs plumbeous horny; iris yellow or brownish yellow.

Measurements.—Wing 7·2″ to 8″ (183 to 203 mm.); tail 12·2″ to 14·5″ (309 to 373 mm.); bill at front about 1″ (25·4 mm.); tarsus 2·6″ to 2·9″ (66 to 73·6 mm.)

Young Male in first plumage resembles the female, but acquires, apparently at its first moult, a black and white barred throat and neck and a much more boldly marked breast and flanks; the forehead and crown become glossed with green and the white feathers of the cape show as pale grey feathers with black tips and white sub-tips. Short central tail feathers some 8 to 12 inches in length, similar to those of the adult, but duller, are also acquired during the first autumn.

A Chick with the wing quills well developed and evidently capable of strong flight, has the head fulvous, a dark line of chestnut running from the base of the bill and widening at the crown, and again on the nape to cover the whole hind neck; side of head pale dull chestnut buff with two tiny bars of black behind the ear-coverts; chin, throat and foreneck dull, very pale buff; upper parts, wings and tail barred and freckled chestnut, buff and black; below dull pale buff with wide, but indistinct bars of blackish.

Distribution.—Mountains of Western China, Eastern and South-Eastern Tibet, Yunnan and Northern Shan States, and the Kachin Hills in Upper Burmah. It will probably be found at suitable elevations, and in suitable country as far West as the Irrawaddy River.

The first record of this fine Pheasant being found in Burmah was that of Oates in the Appendix to his Manual of Indian Game-Birds, where he notes on a specimen shot by one of the officers on the Burmo-Chinese Boundary Delimitation Commission. The exact locality is not given, but the bird was said to have been shot either in the Bhamo or Myitkyina District.

In 1904 Lieut. Van Someran shot an exceptionally fine male near Sadon in the Myitkyina District, and another was obtained in the cold weather of 1910-11 by Capt. Burd of the 93rd Punjabis, somewhere on the borders of the same district.

Nidification.—As far as I know there is nothing at present on record about the nidification of this bird in a wild state, and the only details I have in regard to their nests are some given by native collectors, together with two clutches of eggs taken in Szechuen. These notes declare the eggs to have been taken from off the ground in heavy forests where they had been laid on a few fallen leaves under the protection of a bush. The two clutches were of 4 and 7 eggs respectively, but, judging from the number of eggs laid by these birds in captivity—a very unsafe guide—they probably lay 10 or 12 eggs in a sitting.

The two clutches of eggs referred to are both a buff stone colour, slightly paler in the four clutch than in the other, and the former again has one egg much paler and also more of a creamy tint than the rest. The eggs in the larger clutch are in shape rather long ovals, distinctly compressed towards the smaller end, those in the smaller clutch are more regular ovals, shorter in comparison and with the smaller end but little more compressed than the larger. The texture is that of an ordinary fowl's egg.

In length the 11 eggs vary between 46·2 and 52·5 mm., and in breadth between 34·2 and 30·6 mm.

The breeding season appears to commence very early, for one of these clutches is dated 6th April 1890, and continues through May well into June. They would not seem to breed below 7,000 feet if as low as that.

General Habits.—There is but little on record about these birds, but where found they appear to be not uncommon from 7,000 feet upwards, at least as high as 10,000 feet, and less frequently up to 12,000 feet, or even higher, where there is sufficient cover. Major F. M. Bailey found them plentiful on the Fei-yueh-ling a few days South of Ta-chien-lu, between 7,000 and 9,000 feet. He describes the cocks as noisy birds, and unwilling to fly. Lieut. Van Someran writing to Mr. Comber says that he found them only at heights of 8,000 feet or over, and that they were common birds on the Chinese side of the Chino-Burmese Frontier.

In China, the habits of this beautiful Pheasant are described at some length by Pére David, who writes:

> " Lady Amherst's Pheasant lives, the whole year round, in " the highest jungle-covered hills of Western Szechuen, " Yunnan, Keoucheou, and the highest hills of Eastern Tibet. " It especially frequents the clumps of wild bamboos which " grow at an altitude of 2,000 to 3,000 metres, and the shoots of " these are its favourite food; indeed it is from this its Chinese " name of Seng-ky (Shoot-fowl) is derived. . . . . In the " wild state it shows a very jealous disposition, and will not " allow the Golden Pheasant to approach the locality in " which it resides; and so one never meets these two bril-" liantly coloured pheasants on the same hill or in the same " valley."

Capt. Davies adds a little more information to that given by previous writers, and says:

> " In Yunnan this species is about as common as the last " mentioned (*P. elegans*), and is found at fairly high eleva-" tions, usually in forests. It is difficult to make individuals " fly, and when they rise they do so without crowing, and with " very little noise of the wings. They appear to be 'soft' " birds, very easily killed. The note is a peculiar rasping " sound. Specimens were obtained in Western Yunnan at " 7,000 feet and in Kweichow 7,700 feet."

They are easy birds to keep and breed in captivity, crossing freely, as might be expected with the Golden Pheasant, the resulting hybrids often being of great beauty. According to Seth-Smith their hybrids are perfectly fertile.

(*To be continued.*)

SUMMARY OF THE RESULTS FROM THE INDIAN MAMMAL SURVEY

OF THE

BOMBAY NATURAL HISTORY SOCIETY.

(By R. C. Wroughton.)

INTRODUCTION.

A short history of Indian Mammalogy.

The Golden Age of Indian Mammology was undoubtedly the second quarter of the nineteenth century, and equally without doubt the chief figure in it was Brian Houghton Hodgson. Before him only a very few adventurous foreign travellers such as Belanger, Leschenault, &c., did a little sporadic collecting.

Hodgson collected in Nepal from about 1830 to 1845, and the following is a list of some of his contemporaries who were interested in Mammalogy :—

Barbe, in Pegu.
Boys, in Rajputana.
Berdmore, in Lower Burma.
Elliot, in S. Maratha Country.
Griffith, in N. W. Frontier and Assam.
Heath, in Madras.
Hutton, in Kandahar and Mussoorie.
McClelland, in Assam.
Phayre, in Lower Burma.
Sykes, in the Dekhan.
Tickell, in Orissa.
Tytler, in Kumaon and Andamans.

While all these were collecting, Gray, in London, Blyth, in Calcutta, Jerdon, in Madras, and Kelaart, in Ceylon, were studying and classifying. It must not, however, be understood that the former only collected and the latter only studied. Quite the reverse is the case. Hodgson published many studies and caused to be made an exhaustive collection of drawings, by native artists, of the vertebrate fauna of Nepal, and almost all the others, mentioned in the list of collectors, published studies to a greater or less extent. Similarly, except Gray, all the students mentioned collected as opportunity offered.

After 1850, however, little was done, and there are scarcely any names of workers to record, the chief were Hume, especially in South Burma, Dr. Theobald, Col. Ward, in Kashmir, H. Ferguson, in Travancore, Maj. Birrell and Maj. Dunn in the Punjab and Capt. Whitehead, mostly in Central India as collectors, and Anderson, Blanford, Horsfield and Scully as students.

When Blanford prepared his "Mammalia," 25 years ago, he found but little in the National Collection to help him beyond the remains of the collections of the early part of the century, and even up to and after the commencement of the present century the position was not much more satisfactory. In the early days collections consisted to a very large extent of spirit specimens, and where this was not so, the specimens were not only badly made up but no details of exact locality and date were recorded.

In 1911 this Society launched its Mammal Survey of India, which has now unfortunately been interrupted (temporarily let us hope) by the War, before its work was even half done, but not until some 17,000 specimens had been collected and despatched to the British Museum of Natural History for study.

Scope of this Summary.

About a year ago Mr. Thomas suggested to me that the present time and circumstances presented a favourable opportunity to summarise the results from the study of the Survey Collections. On approaching the task it was evident that if limited to a mere list of the forms obtained, both old and new, the Summary, though not without interest, would be of little practical value. Something of the sort will be found in an Appendix at the end of this Summary. When the restricted meaning which we have given to the word 'results' in the Journal, in connection with the survey, was widened to include also the *indirect* results, the question at once arose, where is the line to be drawn? The only logical solution appeared to be that the Summary must deal with all changes of the nomenclature adopted by Blanford in his Mammalia which have been shown to be necessary not only in the course of our study of the Survey material, but also by those of other Mammalogists who have worked at the subject since that work was published.

Form of the Summary.

A further and no less important question which had to be solved was the form to be given to the Summary. Blanford's Mammalia, though out of date, is still the recognised handbook of Indian Mammalogy, and it seemed absolutely necessary that the Summary should be kept in close touch with it. Very considerable changes have been adopted in nomenclature during the last 25 years. Groups treated as 'Genera' by Blanford are now in many cases accepted as 'Subfamilies,' each including several, often many, Genera. The only satisfactory way seemed to me to link the 'Mammalia' and the 'Summary' through the 'Species,' and to that end I adopted the following arrangements. The larger groups from 'Orders' down to and including 'Genera' have been arranged with keys at each stage. It should be remembered that all the keys in this Summary have been drawn up for the forms found in India, Burma and Ceylon and that if applied to forms outside that fauna they will be found in many cases to be entirely misleading.

The information under each Genus has been arranged in three parts :—

Firstly.—In the margin are given the 'No. and specific name,' exactly as used by Blanford, while against them is recorded, as shortly as possible, the alterations and additions adopted since 1891, with references as far as possible to the places where the reasons for the changes in question are recorded in greater detail.

Secondly.—A key to the forms thus shown to be included in the Genus.

Thirdly.—A note headed DISTRIBUTION, under which the information is arranged under three heads.

"*Type locality*".—The exact place, so far as it is ascertainable, where the type of the Species was taken, followed in brackets by the name of the Collector, where known. (It was originally suggested that I should record the name of the person who first took the species, but I found that this would require much more work than it was worth and I compromised as explained above.)

"*Other localities*".—Blanford's heading 'Distribution,' in view of the changes which it has been found necessary to make in his 'species,' has become actually misleading. The localities recorded here are those from which there are specimens in the National Collection, (B. M.), or those from which the form has been obtained by the Mammal Survey of India, (M.S.I.). (Where specimens other than the type have been obtained from the type locality that locality is repeated under this head. Where the entry is 'none' it denotes that the type specimen is still unique.)

"*Type*".—Under this head it has been endeavoured to record as exactly as possible the present resting place of every type specimen. Where lists of types have been published (*e.g.*, Ind. Mus. Calcutta, U. S. Nat. Mus., &c.) the exact specimen is indicated, but elsewhere, though a probable place is denoted, this must not be taken as a guarantee that the type still exists. In a considerable number of cases, especially of Hodgson's names, no one 'type' was selected by the author and in such cases the series on which the name was based have been treated as 'co-types' and after careful examination and investigation Thomas has fixed 'Lectotypes' (J. B. N. H. S., Vol. XXV, p. 368, 1918). These have been recorded here. Where the types or lectotypes of synonyms have been traced they have been recorded in brackets after the principal type.

DESIDERATA.

Our Honorary Secretary has suggested that a list of forms of which specimens are specially required should be added, but this I have found to be quite impossible. Any Member who desires to help, and I hope there may be many, need only study the heading 'Other localities' and compare it with the Appendix to be able to see for himself the direction in which he can best help. I may take this opportunity however to point out that what is most required are series from the fauna which surrounds the Collector, and that recorded details of locality and date accompanying a specimen enormously increase its value, and finally that a series is very much more valuable than single specimens.

In conclusion I venture to offer my congratulations to Messrs. Millard and Kinnear on the great success of the Survey to date, which is so largely due to their untiring services in its organisation and administration, and to the work in the field of Messrs. Crump, Shortridge, Mayor, Prater, and N. A. Baptista. I trust that the example set by Mr. J. M. D. Mackenzie, I.F.S., in making collections in the Chin Hills and Pegu in aid of the Survey may find many imitators. Finally I desire to record my indebtedness to my friend Oldfield Thomas, who originally suggested this Summary, and without whose continuous advice and help I could not have completed it; also to Mr. W. R. Sherrin of the Natural History Museum, whose ever ready help in handling the specimens and recording the results has enormously lessened my labours.

SUMMARY.

MAMMALIA.

This class is represented in India by only one subclass, the placental mammals, or *Eutheria*.

Subclass: EUTHERIA.

This subclass contains nine Orders, which are arranged by Blanford in a key (slightly modified) as follows :—

Key to the orders of the EUTHERIA.

I. Posterior limbs present.

A.—Hallux, or pollex, or both, opposable to other digits ... ... *I. Primates.*

B.—Neither hallux nor pollex opposable.

a. Animal modified for free flight in the air ; fingers abnormally developed to support a membranous wing... *II. Chiroptera.*

b. Animal not modified for free flight in air.

a^1. Jaws armed with teeth.

a^2 Feet terminating in distinct toes, with claws or nails.

- *a^3*. Incisors in front of the upper and lower jaw, either not two in number, or not chisel shaped.
  - *a^4*. Anterior and posterior limbs connected by an integumentary expansion forming a parachute; incisors compressed, multicuspidate ... ... *IV. Dermoptera.*
  - *b^4*. Anterior and posterior limbs not joined to form a parachute; incisors conical.
    - *a^5*. Snout very pointed; upper lip projecting far beyond lower; median pair of incisors larger than the others ... *III. Insectivora.*
    - *b^5*. Upper lip, not projecting beyond lower; median pair smaller than the other incisors. *V. Carnivora.*
- *b^3*. Two chisel shaped incisors in front of each jaw ... ... *VI. Rodentia.*
- *b^2*. Feet either not terminating in distinct toes, or furnished with hoofs, or hoof-shaped nails ... *VII. Ungulata.*
- *b^2*. Jaws toothless ... ... *VIII. Edentata.*

II. No external posterior limbs; body modified for swimming.
- *A.*—Homodont, or toothless; breathing orifice usually on top of head; mammæ inguinal ... ... *IX. Cetacea.*
- *B.*—Heterodont; breathing orifice at end of snout; mammæ pectoral ... ... *X. Sirenia.*

Order I. Primates.

There are two Suborders, distinguishable as follows:—

Key to the Suborders of the Primates.

A.—Orbit completely enclosed by bone behind; pollex short, or wanting; second digit of foot with a nail; upper incisors not divided by a vacant space in the middle... ... ... *I. Anthropoidea.*

B.—Orbit opening behind into temporal fossa, beneath the postorbital arch; pollex long; second digit with a long claw; upper incisors divided by a space in the middle ... ... *II. Lemuroidea.*

Suborder I. ANTHROPOIDEA.

Besides the HOMINIDAE, there are two families recognisable at follows :

Key to the families of the ANTHROPOIDEA.

A.—No tail; arm longer than leg ... *I. Simiidæ.*
B.—A tail present; arm not longer than leg ... ... *II. Cercopithecidæ.*

Family I. SIMIIDÆ.

GENUS HYLOBATES.
No. 1. *hoolock*, Harl.
No. 2. *lar*, L.

The family is represented by only one genus. I have found no reason to make any changes in this group. I reproduce a key to the Genus from Blanford, for convenience of reference, as follows :—

Key to the species of HYLOBATES.

A.—A white, or grey, band across the forehead; hands and feet same colour as the body ... ... 1. *H. hoolock*, Harl.
B.—Hands, feet, and a ring of hair surrounding the face, white or whitish... 2. *H. lar*, L.

DISTRIBUTION :—

1. *H. hoolock*, Harlan. *Type locality* :—Garo Hills. (Dr. Burrough).
Other localities :—Sadya, Upper Assam (B. M.), Upper Chindwin (M. S. I.).
Type :—Unknown.

2. *H. lar*, Linnæus. *Type locality* :—" India. "
Other localities :—S. W. Siam; Malacca; &c. (B. M.), Tenasserim (M. S. I.).
Type :—Unknown.

Family II. CERCOPITHECIDÆ.

The following is a key to the only two genera (Indian) of this family, *viz.* :—

Key to the genera of the CERCOPITHECIDÆ.

A.—Cheek pouches; tail variable ... *I. Macaca.*
B.—No cheek pouches; tail always long... *II. Pithecus.*

Gen. 1. MACACA.

There is little doubt that the real name for this genus is SIMIA, but that name has been used for a long period of years for the Orang Utan, and it is now proposed to except it, by " fiat, " from the strict rule of priority (Thomas. A. M. N. H. (8), xvii, p. 179, 1916). Pending the final settlement of this matter it seems most convenient to use the next oldest name. Blanford accepted Lacépède's name MACACUS (1801) but two years earlier the latter had used MACACA (Tabl. Mamm. 4, 1799).

No. 3. *rhesus*, Aud.
No. 4. *assamensis*, McCl.

Considerable misunderstanding seems to have arisen as to these two species owing to the loss of the type of *assamensis*, and the absence of topotypes. Study of the Survey specimens leads me to the conclusion that the *assamensis* of Blanford represents the macaques of the Chindwin and Shan States, and that *pelops*, Hodgson, is a distinct species (J. B. N. H. S., XXIV., p. 476, 1916). It seems to me impossible to lump these three species under one heading, *viz.* :—" Colour brown," as in Blanford's key, under A. b.

True (Proc. U. S. N. M., xvii, p. 2, 1894) has given the name of *villosus* to the Kashmir form of *rhesus*. (A specimen collected by Capt. F. D. Sterling at Kaotai, 3,600′, Lower Chitral, sent to the B. M. for identification by the B. N. H. S., would seem to be this form.)

No. 5. *silenus*, Schreb.

Blanford notes that neither *silenus* nor *veter* are applicable as names for this monkey, consequently the name *ferox*, Shaw (Mus. Lev., p. 69, 1792) must be used for it.

No. 6. *arctoides*, Geoff.
No. 7. *leoninus*, Bl.
No. 8. *nemestrinus*, L.
No. 9. *cynomolgus*, Sshreb.
No. 10. *sinicus*, L.
No. 11. *pilaetus*, Shaw.

The name *nemestrinus*, L., was based on the form from Sumatra. Miller established *adusta*, (Proc. U. S. N. Mus. xxix., p. 559, 1906) for the continental form, marked by the almost complete absence of the dorsal black stripe and by the black annulations present in the hairs of the back (J. B. N. H. S., xxiii, p. 700, 1915). Blanford admittedly uses the name *cynomolgus* wrongly (Mamm., p. 23.) Bonhote pointed out (Fasc. Mal. I, p. 4, 1903), that the oldest name for the Malay macaque is *fascicularis*, Raff. With these alterations the marginal list stands.

I propose to substitute for Blanford's the following modified key, *viz.* :—

Key to the species of MACACA.

A.—Tail less than three-fourths of head and body together.

a. Colour black, a grey ruff round face ... 1. *ferox* Shaw.
b. Colour brown or greenish grey.
a^1 Tail about half as long as head and body together.
a^2 Colour rich brown; size large (greatest length of skull 150 mm.). 2. *pelops*, Hodgs.
b^2 Colour greenish grey; size smaller (greatest length of skull 130mm.)
a^3 Throat, chest, and abdomen, well haired, white.
a^4. Hair comparatively short and sleek (45 mm.) ... ... 3. *r. rhesus*, And.
b^4. Hair comparatively long and rough (80 mm.) ... ... 4. *r. villosus*, True.
b^3 Throat, chest, and abdomen, very sparsely haired, greyish, [McCl.
or reddish ... ... 5. *assamensis*,
^{1} Tail less than half the length of head and body.
a^2 Tail about one-third as long as head and body, very slender.
a^3 A distinct horseshoe-shaped crest on the crown ... ... 6. *leonina*, Bly.
b^3 No distinct crest ... ... 7. *adusta*, Mill.
b^2 Tail very short, only one or two inches long ... ... 8. *arctoides*, Geoff.
B. Tail more than three-fourths of head and body together.
a Hair of crown lengthened and distinctly radiating from the middle.
a^1. General colour greyish brown, not rufous ... ... 9. *sinica*, L.
b. General colour rufous or yellowish...10. *pileata*, Shaw.
b Hair of crown neither lengthened nor radiating ... ...11. *fascicularis*, Raff.

DISTRIBUTION :—

1. *M. ferox*, Shaw. *Type locality* :—Ceylon.
Other localities :—Ceylon (B. M.).
Type :—Unknown.

2. *M. pelops*, Hodgson. *Type locality*:—North Nepal (Hodgson.
Other localities.—Nepal (B.M.), Batasia, Dikchu, Darjiling, Sikkim (M. S. I.).
Type :—B. M. No. 43.1.12.4.

3. *M. rhesus*, Audebert.	*Type locality* :—Unknown. *Other localities* :—Sikkim (Blanford) (B. M.); Central Provinces; Kumaon; Behar; Orissa; Darjiling; Bhutan Duars (M. S. I.). *Type* :—Unknown (Type of *oinops*, Hodgson, B. H. No. 43.1.12.5).
4. *M. rhesus villosus*, True.	*Type locality* :—Lolab Kashmir (Dr. Abbott). *Other localities* :—None. *Type*:—U.S.N.M. No. $\frac{20120}{35485}$.
5. *M. assamensis*, McClelland.	*Type locality* :—Assam (McClelland). *Other localities* :—Chindwin; Shan States; Mt. Popa (M. S. I.). *Type*:—Lost.(Type of *problematicus*, Gray, B. M. No. 69.3.5.15; Type of *rheso-similis*, Sclater, B. M. No. 69.3.5.15).
6. *M. leonina*, Blyth.	*Type locality* :—Arakan (Col. Phayre). *Other localities* :—Arakan (B. M.); Chindwin (M.S.I.). *Type* :—Ind. Mus. Calc. No. 43a.
7. *M. adusta*, Miller.	*Type locality* :—Champang, Tenasserim (Dr. W. L. Abbott). *Other localities* :—Malay Peninsula (B. M.); Tenasserim (M. S. I.). *Type*:—U. S. N. Mus. No. 124023.
8. *M. arctoides*, Geoffroy.	*Type locality* :—Cochin China (Diard). *Other localities* :—Malay Peninsula (B. M.). *Type* :—Unknown. Perhaps in Paris Museum. (Type of *melanotus*, Ogilby, B.M. No. 55.12.24.25; Type of *brunneus*, Anderson Ind. Mus. Calc. No. 45b.).
9. *M. sinica*, Linnæus.	*Type locality*:—"In India orientale." *Other localities* :—Travancore; 'Madras" (Jerdon) (B. M.); Western Ghats; Dharwar; Kanara; Bellary; Mysore; Coorg (M. S. I.). *Type* :—Unknown.
10. *M. pileata*, Shaw.	*Type locality*:—Ceylon.

Other localities :—Habbentota, Ceylon (B. M.), North and North-east Provinces, Ceylon (M. S. I.).

Type :—Unknown.

11. *M. fascicularis*, Raffles.

Type locality :—Sumatra (Raffles).

Other localities :—Malay Peninsula (B. M.); Tenasserim (M. S. I.).

Type :—Unknown.

Gen. II. PITHECUS.

Thomas has recently pointed out (A. M. N. H. (8), xvii, p. 179, 1916), that this name was based by Geoffroy and Cuvier (1795) on a Ceylon monkey which, whatever its species, was a langur and not a macaque, hence it is the oldest name for the langurs, and must be used in place of SEMNOPITHECUS, adopted by Blanford (Mamm., p. 25).

No. 13. *entellus* Dufr.
No. 13. *schistaceus*, Hodgs.
No. 14. *priam*, Bly.
No. 15. *hypoleucos*, Bly.

These four species form the first section of Blanford's key. But in addition to these Dollman proposes to revive the name *anchises*, Blyth, for the southern race of *entellus*. (J. B. N. H. S., xxii., p. 442, 1913), Elliot has established the name *lanius* for the race of *schistaceus* living on the northern slope of the Himalayas. Finally I have recently described a langur from the Northern Shan States under the name of *shanicus* (J. B. N. H. S., xxv, p. 46, 1917). This, however, had already received a name, by which it must be known, from Elliot, *viz.*, *melamerus* (Rev. Prim., iii, p. 47, 1913).

No. 25. *femoralis*, Horsf.

True *femoralis* was named but not described by Horsfield (Mem. Sir T. S. Raffles, App. p. 462, 1830), who gave the type locality as "in Sumatra et Java." The specimen however was fully described by Martin in 1833 (Charl. Mag. N. H., ii, p. 436) under the same name. Robinson and Kloss separated the Tenasserim form as a subspecies of *neglecta* (*i. e.* of *femoralis*), (Jour. F. M. States, Mus. IV, p. 174, 1911), distinguising it under the name *keatii*, "by its generally brown coloration, absence of white on the chest, and by having the white femoral line produced quite to the heel (J. B. N. H. S., xxiii, p. 702, 1915).

No. 16. *johni*, Fisch.
No. 17. *cephalopterus*, Zimm.
No. 18. *senex*, Erxl.
No. 19. *ursinus*, Bly.
No. 22. *barbei*, Bly.

These species form a third section (*viz.*: C. a.) of Blanford's key. Zimmermann spelt his species name *kephalopterus* and this spelling must be accepted. The name *senex* appears to be undoubtedly a synonym of *veter*, L. Both, as well as *albinus*, Kel., seem to represent an albino of some form of Ceylon monkey, probably either *kephalopterus* or *ursinus*. Still as this is also the genotype of PITHECUS (Thomas, A. M. N. H., xvii, p. 179, 1916), I propose to retain it for the present among the species in my key. Blyth in his original description of *barbei* (J. A. S. B., xvi, p. 734, 1847) gave the type locality as the Ye Province of Tenasserim, but in 1863 (Cat. Mamm. Mus. As. Soc., p. 48) he corrected this, on the authority of the collector, M. Barbe, to "interior of Tipperah Hills". After careful consideration I decided (J. B. N. H. S., xxv, p. 46, 1917) to adopt, at any rate provisionally, the Tenasserim monkey as the representative of *barbei*.

No. 20. *pileatus*, Bly.

This species forms a fourth section of Blanford's key, *viz*., C. b., where it represents the Assam langurs. In 1916 (J. B. N. H. S., xxiv, p. 654), I stated that the name *pileatus* was inadmissible for a langur; I fear I was mistaken. As now advised, I must withdraw that statement and consequently my name *durga* must fall, as a synonym of *pileatus*, Bly. I may note here that I have been successful in tracing the type of *argentatus*, Horsf. (Cat. Mamm. E. I. C. Mus., p. 7, 1851), ranked by Blanford as a synonym of *phayrei*, and it too proves to be *pileatus*, Bly. At the same time that I described *durga*, I proposed the name *brahma* for the langur of Upper Assam. Finally, in dealing with the Chindwin Collection I had already described *shortridgei* (J. B. N. H. S., xxiv, p. 56, 1915), but the subspecies *belliger*, then proposed, cannot stand, for Mr. Shortridge assigns its difference in colour from *shortridgei*, its chief characteristic, to an effect of wood smoke while drying the skins of the specimens. Thus the following must be substituted for *pileatus* in Blanford's list, *viz*., *pileatus*, Bly., Lower Assam; *brahma*, Wr., Upper Assam; and *shortridgei*, Wr., Upper Chindwin.

No. 23. *phayrei*, Bl.
No. 24. *obscurus*, Reid.

These two species represent section C. c. of Blanford's key, *i.e.*, the crested langurs. The second is represented in our area by *crepusculus*, Elliot.

No. 21. *chrysogaster*, Bonap.

This name, which forms the concluding section of Blanford's key, was first used as a synonym of *potenziani*, (J. B. N. H. S., xxiv, p. 653), and consequently must be allowed to drop altogether. The langurs as thus altered may be arranged in a key as follows:—

Key to the species of PITHECUS.

I. Hair of crown radiating from one or more points on the forehead.
  A.—Hair of crown radiating from a central point on forehead.

a. Limbs and tail black ... ... 1. *hypoleucos*, Bly.
b. Limbs and tail not (or little) darker than the body.
a^1. Hands and feet same colour as the limbs.
a^2. Crown of head scarcely paler than body ... ... 2. *priam*, Bly.
b^2. Crown of head white.
a. Hair silky ... ... 3. *schistaceus*, Hodgs.
b. Hair woolly ... ... 4. *s. lanius*, Ell.
b^1. Hands and feet black.
a^2. Small (condylo-basal length of skull 75-85 mm.) Pattern practically unicolorous ... ... 5. *melamerus*. Ell.
b^2. Larger. Pattern mixed dark and light.
a^3. Large (condylo-basal length of skull 95-105 mm.). Tail only occasionally with a long white tip ... ... 6. *entellus*, Dufr.
b^3. Smaller (condylo-basal length of skull 90-95 mm); tail most usually with a long white tip ... ... 7. *e. anchises*, Bly.
B.—Hair of crown radiating from two frontal points, one on each side of the head ... ... 8. *f. keatii*, Rob. & [Kl.
II. Hair of crown directed backwards throughout, not radiating.
A.—No crest.
a. Hair of crown not longer than that on temples and nape.
a^1. Body black or dusky brown above and below.
a^2. Head black throughout like body. 9. *barbei*, Bly.
b^2. Head pale brown.
a^3. Cheeks the same colour as crown ... ...10. *johni*, Fisch.
b^3. Cheeks paler than crown.
a^4. Sacral region grey ...11. *kephalopterus*, Zimm.
b^4. Sacral region black ...12. *ursinus*, Bly.
b^1. Body yellowish white throughout...13. *veter*, L.
b. Hair of crown longer than that of temples and occiput, forming a "cap".

a^1. General colour cinereous.

a^2. Whiskers only slightly paler than the general body colour; under surface coloured like the back ... ...14. *shortridgei*, Wr.

b^2. Whiskers pure white; under surface greyish on the chest, buff on the abdomen... ...15. *brahma*, Wr.

b^1. General colour dusky brown; whiskers and under surface ochraceous ... ...16. *pileatus*, Bly.

B.— A crest of longer hairs.

a. A pointed crest on occiput; adults ashy to blackish brown ... ...17. *crepusculus*. Elliot.

b. Crest compressed and longitudinal on crown of head.

a^1. Body dark grey above, whitish below... ... ...18. *phayrei*, Bly.

b^1. Body white above, grey below ...19. *robinsoni*, Thos.

DISTRIBUTION :—

1. *P. hypoleucos*. Blyth.	*Type locality* :—Travancore (Dr. Coles). *Other localities* :—South Coorg (M.S.I.). *Type* :—Ind. Mus. Calc. No. 13a.
2. *P. priam*, Blyth.	*Type locality* :—Coromandel Coast (Elliot). *Other localities* :—Travancore (B. M.); Ceylon (M. S. I.). *Type* :—Ind. Mus. No. 12a.
3. *P. schistaceus*, Hodgson.	*Type locality* :—Nepal (Hodgson). *Other localities* :—Nepal; Sikkim; Kashmir (B. M.); Kumaon (M. S. I.) *Co-types* :—B. M. No. 43.1.12. 1-3. *Lectotype*:—B. M. No. 43. 1. 12.1.
4. *P. schistaceus lanius*, Elliot.	*Type locality* :—Chumbi, Thibet (B. N. H. S.—F. M. Bailey). *Other localities* :—None. *Type* :—B. M. No. 9.7.16.1.

5. *P. melamerus*, Elliot.	*Type locality* :—Bhamo (Fea). *Other localities* :—N. Shan States (M. S. I.) *Type* :—B. M. No. 88.12.1.64. (Type of *shanicus*, Wroughton, B. M. No. 14.7.8.5).
6. *P. entellus*, Dufresne.	*Type locality* :—" Bengal." *Other localities* :—" Bombay " (Sykes) ; Central Provinces (B. M.) ; Kathiawar ; Nimar ; Berar ; Central Provinces ; Behar ; Orissa (M. S. I.) *Type* :—Unknown.
7. *P. entellus anchises*, Blyth.	*Type locality* :—" Deccan, and along the foot of the Western Ghats". (Elliot). *Other localities* :—Dharwar; Kanara ; Bellary (M. S. I.) *Type* :—Lost (?). Not in Cat. Ind. Mus. Calc. (1881) ; (Blyth's Cat. Mamm. Mus. As. Soc., 1863, No. 27 j.)
8. *P. femoralis keatii*, Robinson & Kloss.	*Type locality* :—Trang, S. W. Siam (Robinson). *Other localities* :—S. Tenasserim (B. M.) ; S. Tenasserim (M. S. I.) *Type* :—Selangor Mus. No. 1231/10.
9. *P. barbei*, Blyth.	*Type locality* :—1st. Ye Province, Tenasserim ; 2nd. Interior of Tippera Hills. (See above). (Rev. J. Barbe). *Other localities* :—N. Tenasserim (B.M.) *Type* :—Ind. Mus. Calc. No. 19a.
10. *P. johni*, Fischer.	*Type locality* :—Tellicheri, Malabar. *Other localities* :—Nilgiri Hills; Coorg (Blanford) (B. M.) ; S. Coorg (M.S.I.). *Type* :—Unknown.
11. *P. kephalopterus*, Zimmermann.	*Type locality* :—" East Indies." *Other localities* :—" Raygun Corola" (Colombo Museum) ;

	Adam's Peak (B. M.) Kottawa, Ceylon (M. S. I.). *Type* :—Unknown. (Type of *thersites*, Blyth, Ind. Mus. Calc. No. 12c. Type of *albinus*, Kelaart, Ind. Mus. Calc. No. 15s.)
12. *P. ursinus*, Blyth.	*Type locality* :—Newara Eliya, Ceylon (Kelaart). *Other localities* :—Pattipola and Hakgalla, Ceylon (M. S. I.) *Type* :—Ind. Mus. Calc. No. 15p.
13. *P. veter*, Linnæus.	*Type locality* :—" In Zeylona". *Other localities* :—None. *Type* :—Unknown.
14. *P. shortridgei*, Wroughton.	*Type locality* :—Homalin, Upper Chindwin River. (B. N. H. S.—Shortridge). *Other localities* :—Homalin and Hkamti (under the name *belliger*), Upper Chindwin (M. S. I.) *Type* :—B. M. No. 15.5.5.10 (Type of s. *belliger*, Wroughton B. M. No. 15.5.5.14.).
15. *P. brahma*, Wroughton.	*Type locality* :—Lakhimpur, Upper Assam (H. Stevens). *Other localities* :—None. *Type* :—B. M. No. 13.2.21.1.
16. *P. pileatus*, Blyth.	*Type locality*:—Unknown (menagerie specimen). *Other localties* :—Silhet; Assam (B.M.). *Type* :—Ind. Mus. Calc. No. 14 d. (Type of *argentatus*, Horsfield, B. M. No. 79.11.21.597; Type of *durga*, Wroughton, B. M. No. 86.10.18.1.)
17. *P. crepusculus*, Elliot.	*Type locality* :—Mt. Muleyit, Tenasserim (Hume-Davison). *Other localities* :—Mt. Muleyit, (M. S. I.) *Type* :—B. M. No. 85.8.1.11.
18. *P. phayrei*, Blyth.	*Type locality* :—Arakan (Col. Phayre). *Other localities* :—Siam (?) (B. M.); Kin, Lower Chindwin;

Ngapyinium, Upper Irrawady; Mt. Popa; Pegu (M. S. I.).

Type:—Ind. Mus. Calc. No. 20 a. Type of *crepuscula*, Elliot. B. M. No. 85.8.1.11).

19. *P. robinsoni*, Thomas. *Type locality*:—Trang, S. W. Siam (Robinson).

Other localities:—None.

Type:—B. M. No. 10.10.1.1.

Suborder II.—LEMUROIDEA.

There is only one family, *viz.*, the LEMURIDÆ.

Family.—LEMURIDÆ.

There are two genera distinguished by Blanford as follows:—

Key to the genera of the LEMURIDÆ.

A.—Either only two incisors, or four of unequal size, the inner pair much larger than the outer; tail present, but very short; limbs not remarkably slender ... ... I. NYCTICEBUS.

B.—Four small upper incisors, of equal size; tail none; limbs very slender ... ... II. LORIS.

Gen. I.—NYCTICEBUS.

No. 25. *tardigradus*, L. This name belongs by right to the Slender Loris of Ceylon (Thomas, A.M.N.H., p. 468, 1908: and P.Z.S., p.129, 1911). The next oldest name is *coucang*, based by Boddaert on the "tailless Macauco" of Pennant (Elench. Anim. i, p. 67, 1785). Pennant's actual description of the animal, a specimen in the Leverian Museum, is unmistakeably that of a NYCTICEBUS. although in his other remarks he seems to confuse NYCTICEBUS and LORIS. No specimen, so far as I know, has ever again been obtained from the type locality, *i.e.*, Bengal (J.B.N.H.S., xxiv., p. 702, 1915).

DISTRIBUTION:—

N. coucang, Boddaert. *Type locality*:—"Bengal."

Other localities:—Lower Pegu (B.M.); Chindwin; Pegu; Tenasserim (M.S.I.).

Type:—Unknown.

Gen. II.—LORIS.

No. 27, *gracilis*, Geoff. Miss Ryley has pointed out how the name *gracilis* came to be substituted for the original *tardigradus* (J. B. N. H. S., xxii., p. 285, 1913). This latter name being the older must be used for the Ceylon Loris. Lydekker, in 1904 (P. Z. S., p. 345), separated the Madras from the Ceylon form, but put the name *gracilis* on the Madras animal, making the Ceylon form a subspecies. under the name *zeylanicus*. Thomas having in the meanwhile (A. M. N. H., i., p. 468, 1908) shown that the Ceylon animal must be called *tardigradus*, Cabrera pointed out that the Madras form was now without a name and suggested for it that of *lydekkerianus*. (Bol. R. S. Espan. Hist. Nat., p. 211, 1908). While going through all the available material for the preparation of this Summary, I found that the Ceylon specimens, though they approached those of *lydekkerianus* from Mysore, were markedly larger and otherwise differed from animals from Malabar, I therefore concluded to separate these latter under the name *malabaricus* (J. B. N. H. S., xxv., p. 45, 1917). These three species, which are all included in the name *gracilis* of Blanford, may be arranged in a key as follows :—

Key to the species of LORIS.

A.—Size large (head and body, 245 mm.: greatest length of skull 52 mm.) ; ears large.
  a. General colour grey ; a median dorsal stripe 1. *lydekkerianus*, Cabr.
  b. General colour brownish grey ; no dorsal stripe ... ... 2. *tardigradus*, L.
B.—Size small (head and body 220 mm.; greatest length of skull 45 mm) ; ears small... ... 3. *malabaricus*, Wr.

DISTRIBUTION.

1. *L. lydekkerianus*, Cabrera.	*Type locality* :—" Madras." *Other localities* :—Kolar District, East Mysore (M.S.I.). *Co-types* :—B. M. No. 3.2. 19.1. and 2. *Lectotype* :—B.M. No.3.2.19.1.
2. *L. tardigradus*, Linnæus.	*Type locality* :—" Ceylon." *Other localities* :—Ceylon (M. S.I.). *Type* :—Unknown. (Type of *Zeylanicus*, Lydekker, B. M. No. 4.10.12.3.).
3. *L. malabaricus*, Wroughton.	*Type locality* :—Kutta, S. Coorg (B.N.H.S.—Shortridge). *Other localities* :—Travancore (B.M.) ; S. Coorg (M.S.I.). *Type* :—B. M. No. 13.8.22.3.

Order II.—Chiroptera.

Such great strides have been made in the classification of the bats since Blanford published his "Mammalia," that I have found it necessary to go into the currently accepted distribution, not only as it affects the genera, but the Families and Subfamilies. The most recent works are Miller's "Families and Genera of Bats," 1908, and K. Andersen's "Catalogue of the Chiroptera," Vol. I. (Fruit Bats), 1912. Both these, it will be seen, were published before Survey specimens were available. I have followed as closely as possible the two works quoted above, so far as they deal with the Indian fauna, *viz.*, Miller for the general classification and Andersen for the Megachiroptera. The Families may be arranged in a key as follows :—

Key to the Families of the Chiroptera.

- *A.*—Neither nose-leaf nor tragus present ... I. Pteropodidæ.
- *B.*—Either nose-leaf or tragus, or both, present.
  - *a.* Both nose-leaf and tragus present.
    - *a'.* Face not grooved; nose-leaf large, up-standing ... ... III. Megadermatidæ.
    - *b'.* Face grooved; nose-leaf small, folded down ... ... IV. Nycteridæ.
  - *b.* Either a nose-leaf or a tragus present, but not both.
    - *a'.* A nose-leaf but no tragus present ... II. Rhinolophidæ.
    - *b'.* No nose-leaf but a tragus present.
      - a^2. Tail entirely enclosed in interfemoral membrane ... ... V. Vespertilionidæ.
      - b^2. A portion of the tail free.
        - a^3. Tail emerging from the upper surface of the interfemoral membrane comparatively short and stout ... ... VI. Emballonuridæ.
        - b^3. Tail emerging from the end of the interfemoral membrane.
          - a^4. Tail very long and slender ... VII. Rhinopomidæ.
          - b^4. Tail comparatively short and stout ... ... VIII. Molossidæ.

Family I.—Pteropodidæ.

The six Genera of the Family may be arranged in a key as follows :—

Key to the Genera of the Pteropodidæ.

- I. Tongue moderate; inner margin of the nostril projecting.

A.—Upper part of one colour throughout.
a. Five teeth in upper molar series, six in lower ... ... I. ROUSETTUS.
b. Four teeth in upper molar series, five in lower.
a'. Calcar present ... ... III. CYNOPTERUS.
b'. Calcar absent ... ... IV. SPHÆRIAS.
B.—Hind neck and shoulders generally paler than back ... ... II. PTEROPUS.
II. Tongue very long; no projecting margin to nostril.
a. No claw to index; wing from base of first toe; tail distinct ... V. EONYCTERIS.
b. A claw to index; wing from base of fourth toe; tail rudimentary ... ... VI. MACROGLOSSUS.

Gen. I.—ROUSETTUS.

Blanford uses XANTHARPYIA, established by Gray in 1843 (List Spec. Mamm. B. M., xix, p. 37) but that author had already used ROUSETTUS in 1821 (Lond. Med. Repos., xv, p. 299) which therefore as the older name must be used for the genus.

No. 137. *amplexicaudatus*, Geoff. Blanford uses this single name to cover all the Indian forms of the genus.

K. Andersen however recognises three species which may be arranged in a key as follows:—

Key to the species of ROUSETTUS.

A.—Pollex 30-37.5 mm; second phalanx of third digit 50.5-61.5 mm. ... ... 1. *arabicus*, And. de Wint.
B.—Pollex 24-30 mm.; second phalanx of third digit 36-47.2 mm.
a. Fur on nape and shoulders not unusually sparse; forearm 80.5-87.5 ... 2. *leschenaulti*, Desm.
b. Nape, and shoulders semi-naked; forearm 79-85.5 mm. ... ... 3. *seminudus*, Kel.

DISTRIBUTION:—

1. *R. arabicus*, Anderson & de Winton. *Type locality*:—Lahej, Aden (Col. Yerbury).

Other localities:—Muscat, Oman; Karachi, Sind (B. M). Not obtained by Survey.

Type:—B. M. No. 95. 6.1. 47.

2. *R. leschenaulti*, Desmarest. *Type locality*:—Pondichery. (Leschenault).

Other localities:—Nepal; Nasiriabad, Rajputana (Boys); Myingan, Burma (B. M.); Western Ghats, Bombay; Coorg; Kumaon; Bhutan Duars; Mt. Popa; Upper Burma; Tenasserim (M. S. I.).

Co-types:—Paris Museum (Type of *Cynopterus affinis*, Gray. B. M. No. 38.3.13.37. Type of *Pteropus pyrivorus*, Hodgs. B. M. No. "not registered." Type of *Eleutherura fuliginosa*, Gray. B. M. No.62.8.18.5. Type of *Eleutherura fusca*, Gray. B. M. No. 49.8.23.10.).

3. *R. seminudus*, Kelaart. *Type locality*:—Mt. Lavinia, Ceylon (Kelaart).

Other localities:—Punduloya, Ceylon (B. M.); Hambantota, Urugala, and Kandy, Ceylon (M. S. I.).

Type:—Ind. Mus. Calc. No. 94 b.

Gen. II.—PTEROPUS.

No. 134. *medius*, Temm.
No. 135. *edulis*, Geoff.
No. 136. *nicobaricus*, Fitz.

The specific names in this genus have been so confusingly intermixed that it would be a waste of time to try and fix the exact equivalents of Blanford's three species. K. Andersen adopts the name *giganteus*, Brünnich, for the common Flying Fox of India, with a doubtful subspecies, *leucocephalus*, Hodgs., from the high hills above Nepal. Besides this he recognises the following forms as occurring or likely to occur within our area, *viz.*, *hypomelanus*, *intermedius*, and *melanotus*. These may be arranged in a key as follows:—

Key to the species of PTEROPUS.

A.—Posterior basal ledges of large premolars distinct.
  a. Interfemoral scarcely developed in centre; forearm 134-137 mm. ... 1. *hyp. geminorum*, Mill.
  b. Interfemoral distinct in centre; forearm 153-165 mm. ... ... 2. *melanotus*, Blyth.
B.—Posterior basal ledges of premolars practically obliterated.
  a. Underside of body paler than back; forearm 163-177.

a'. Far shorter, 8-12 mm. on back ... ... 3. *gig. giganteus*, Brünn.

b'. Fur longer, 15-18 mm. on back ... ... 4. *gig. leucocephalus*, Hodgs.

b. Underside of body quite or nearly as dark as back; forearm about 180 mm. ... ... 5. *intermedius*, K. And.

DISTRIBUTION :—

1. *P. hypomelanus geminorum*, Miller.	*Type locality* :—South Twin Island, Mergui Archipelago (Dr. W. L. Abbott). *Other localities* :—S. Twin Island (B. M.). *Type* :—U. S. Mus. No. 104464.
2. *P. melanotus*, Blyth.	*Type locality* :—Nicobar Islands. (Capt. Lewis). *Other localities* :—Nicobars (Hume) (B M.). *Type* :—Ind. Mus. Calc. No. 92b.
3. *P. giganteus giganteus*, Brünnich.	*Type locality* :—Bengal. (Unknown). *Other localities*:—Saugor, Central Provinces; Neemuch, Rajputana; Dharwar (Elliot); Travancore; Ceylon (B. M.); Cutch; Kathiawar; Palanpur; Nimar; Berars; Central Provinces; Koyna Valley; Dharwar; Bellary; South Mysore; Ceylon; Kumaon; Bengal; Sikkim; Bhutan Duars; Pegu (M. S. I.). *Type* :—Copenhagen Museum.
4. *P. giganteus leucocephalus*, Hodgson.	*Type locality* :—Nepal (Hodgson). *Other localities*:—Nepal; Assam; Manipur (B. M.). Not obtained by Survey. *Co-types* :—B. M. Nos. 45.1.8.273-275; 45.5.15.4.

Lectotype :—B. M. No. 45.1.8.273.

5. *P. intermedius*, K. Andersen.

Type locality :—Amherst, Burma (Hume-Davison).

Other localities :—None.

Type :—B. M. No. 85.8.1.101.

Gen. III.—Cynopterus.

No. 138. *marginatus*, Geoff.
No. 139. *brachyotus*, Mill.
No. 140. *scherzeri*, Fitz.
No. 141. *brachysoma*, Dobs.

Miller has separated *blanfordi*, Thos., as a distinct genus. Andersen adopts *sphinx*, Vahl, as being an older name than *marginatus* and declines to accept true *brachyotis*, Müll., as occurring within our limits, but substitutes for it the subspecies *angulatus*, Mill. The change required in the key may be made as follows:—

Key to the species of Cynopterus.

A.—Ears relatively longer, 18-20.5 mm.
  a. Smaller, forearm 66-73.5 mm. ... 1. *sph. sphinx*, Vahl.
  b. Larger, forearm 73-78 mm.. ... 2. *sph. gangeticus*, K. And.
B.—Ears relatively shorter, 13-18 mm.
  a. Larger, forearm 65-72 mm. ... 3. *brach. angulatus*, Mill.
  b. Smaller, forearm 54.5-70 mm.
    *a*¹. Ears relatively larger, 15-17 mm. ... ... 4. *brach. ceylonensis*, Gray.
    *b*¹. Ears relatively shorter, 13-15 mm.
      *a*². Smaller, forearm 59-66 mm. ... ... 5. *brach. brachysoma*, Dobs.
      *b*². Larger, forearm 69.5-70 mm. ... ... 6. *brach. scherzeri*, Zeleb.

Distribution :—

1. *C. sphinx sphinx*, Vahl.

Type locality :—Tranquebar, Madras.

Other localities :—Bombay ; Dharwar ; Madras (Jerdon) ; Travancore (B. M.) ; Kanara ; Mysore ; Coorg ; Ceylon ; Bengal ;

	Kumaon; Sikkim; Darjiling; Bhutan Duars; Chin Hills; Chindwin; Shan States (M. S. I.). *Type*:—Unknown (Co-types of *C. ellioti*, Gray, B. M. Nos. 40 k & l. Lectotype, B. M. No. 40k).
2. *C. sphinx gangeticus*, K. Andersen.	*Type locality*:—Lucknow. (B. N. H. S.—Maj. Begbie). *Other localities*:—Palanpur; Nimar; Central Provinces (M. S. I.). *Type*:—B. M. No. 10. 11.14.1.
3. *C. brachyotis angulatus*, Miller.	*Type locality*: —Trang, Lower Siam. (Dr. W. L. Abbott). *Other localities*:—Chindwin (B.M.); Tenasserim (M.S.I.). *Type*:—U. S. Nat. Mus. No. 83569. (in al).
4. *C. brachyotis ceylonensis*, Gray.	*Type locality*:—Ceylon (Thwaites). *Other localities*:—Punduloya, Ceylon (B. M). Not obtained by the Survey. *Co-types*:—B. M. Nos. 52.2. 19.1. & 58.10.19.12. *Lectotype*:—B. M. No. 58.10. 19.12.
5. *C. brachyotis brachysoma*. Dobson.	*Type locality*:—South Andaman Island (Col. Tytler). *Other localities*:—None. *Type*:—Ind. Mus. Calc. No. 99/.a. (Co-types of *C. marginatus andamanensis*, Dob.B.M. Nos. 9.4.4.1. & 2.)
6. *C. brachyotis scherzeri*, Zelebor.	*Type locality*:—Car Nicobar. *Other localities*:—None. *Co-types*:—Presumably in Vienna Museum.

Gen. IV.—SPHÆRIAS.

No. 142. *blanfordi*, Thos. Miller separated this genus from CYNOPTERUS in 1906 (Proc. Biol. Soc. Wash., XIX., p. 83).

DISTRIBUTION :—

S. blanfordi, Thomas. *Type locality* :—Karin Hills, Burma (Fea).

Other localities :—The original three specimens collected by Fea are the only ones known.

Co-types :—B. M. No. 90.4.7.6. and specimen in Genoa Museum.

Gen. V.—EONYCTERIS.

No. 144. *spelæa*, Dobs. No change required.

DISTRIBUTION :—

E. spelæa, Dobson. *Type locality* :—Farm Caves, Moulmein. (Theobald).

Other localities :—Nan, Siam; Malay Peninsula (B. M). Tenasserim (M. S. I.).

Type :—Ind. Mus. Calc. No. 100 a.

Gen. VI.—MACROGLOSSUS.

Blanford used the name CARPONYCTERIS, holding that MACROGLOSSUS was antedated by MACROGLOSSA, Ochs. 1816, but this view is not generally accepted, the terminal difference being held to be sufficient in the case of a generic name.

No. 143. *minimus*, Geoff. Dr. Andersen restricts true *minimus* to the Java form and establishes a subspecies *sobrinus* for the Malay Peninsula and northwards.

DISTRIBUTION :—

M. minimus sobrinus, K., Andersen. *Type locality* :—Gunong Ikari, Perak (A. L. Butler).

Other localities:—Tenasserim (M. S. I.).

Type :—B. M. No. 98.11.29.1.

NOTE :—In preparing this summary of the PTEROPODIDÆ, I have relied entirely on Vol. 1 of Dr. Andersen's "Catalogue of the Chiroptera" (1912), the latest authoritative work on the subject. It was published before the Survey was at work, but so far as I can judge, extremely little or no change (certainly no important change) would have been necessitated, had it been otherwise, beyond some additions to the distribution details, which are here furnished. The comparison and study for Vol. 2 have been practically completed by Dr. Andersen, and I have his assurance that for the Indian portion of his work, the Survey material has been of invaluable assistance. Unfortunately the formulation and publication of his results have been unavoidably postponed, and they are not available to me in preparing this summary. Dr. Andersen however published in 1905 several papers on the Rhinolophidæ on which I have relied.

Family II.—Rhinolophidæ.

Three Genera are represented which may be distinguished as follows :—

Key to the genera of the Rhinolophidæ.

A.—First toe with only two joints; a distinct antitragus separated by a notch from the outer margin of the ear... ... ... I. Rhinolophus.
B.—All toes with only two joints; no notch separating the antitragus from the outer margin of the ear ... ...
  a. Anterior nose-leaf on horseshoe not divided in the middle ... ... II. Hipposideros.
  b. Anterior nose-leaf divided into distinct lappets ... ... III. Coelops.

Gen. I.—Rhinolophus.

In 1905, Dr. Andersen published a paper (A. M. N. H. 7., xvi. p. 648), in which he divided this genus into a number of groups, and I think the most satisfactory arrangement will be to take them one at a time. They may be arranged in a key as follows :—

Key to the groups of Rhinolophus.

A.—Connecting process absent ... ... VI. *arcuatus* Group.
B.—Connecting process present.
  a. Sella trifoliate ... ... IV. *philippensis* Group.
  b. Sella not trifoliate.
    a^1. Connecting process starting below top of sella ... ... V. *macrotis* Group.
    b^1. Connecting process starting at top of sella.
      a^2. Connecting process high and prominent ... ... II. *lepidus* Group.
      b^2. Connecting process low.

a^3. Connecting process tapering upwards almost to a point. III. *midas* Group.
b^3. Connecting process not tapering upwards ... ... I. *simplex* Group.

I. *simplex* Group.

No. 150. *affinis*, Horsf.
No. 151. *andamanensis*, Dobs.
No. 152. *petersi*, Dobs.
No. 156. *ferrum-equinum*, Schreb.
No. 157. *tragatus*, Hodgs.

These five species represent the *simplex* Group of Andersen's arrangement, in which he includes nine forms which may be arranged in a key as follows:—

Key to the species of the R. simplex Group.

A.—Size smaller, forearm about 50 mm.
  a. Sella pandurate.
    a^1. Margin of posterior nose-leaf concave.
      a^2. Ears large; tail long ... 1. *aff. macrurus*, K. And.
      b^2. Ears small; tail short.
        a^3. Size larger; horse-shoe narrow ... ... 2. *aff. himalayanus*, K. And.
        b^3. Size smaller; horse-shoe broad ... ... 3. *aff. tener*, K. And.
    b^1. Margin of posterior nose-leaf straight ... ... 4. *andamanensis*, Dobs.
  b. Sella parallel-sided.
    a^1. Horseshoe broader ... ... 5. *rouxi*, Temm.
    b^1. Horseshoe narrower ... ... 6. *thomasi*, K. And.
B.—Size larger, forearm about 60 mm.
  a. Size larger, forearm 58.7-63 mm.
    a^1. Horsehoe broader, 8.8-9.7 mm. 7. *f. equi. tragatus*, Hodgs.
    b^1. Horseshoe narrower, 8.2-8.8 mm. ... ... 8. *f. equi. regulus*, K. And.
  b. Size smaller. 56.8-58 mm; horse-shoe 7.7-8 mm. ... ... 9. *f. equi. proximus*, K. And.

DISTRIBUTION :—

1. *R. affinis macrurus*, K. Andersen. *Type locality*:—Karin Hills, Burma. (Fea).
Other localities:—None.
Type:—B. M. No. 90 4·4.7. (in al.).

2. *R. affinis himalayanus*, K. Andersen.	*Type locality*:—Mussoorie, United Provinces (Hutton). *Other localities*:—Mussoorie; Nepal; Darjiling (B. M.). Bhutan Duars; Chindwin (M. S. I.) *Type*:—B. M. No. 79.11.21. 148. (in al.).
3. *R. affinis tener*, K. Andersen.	*Type locality*:—Pegu, Burma (W. Theobald). *Other localities*:—None. *Type*:—B. M. No. 87.3.4.11. (in al.).
4. *R. andamanensis*, Dobson.	*Type locality*:—South Andaman Island. (J. Homfray). *Other localities*:—None. *Type*:—Indian Mus. Calc. No. 110a.
5. *R. rouxi*, Temminck.	*Type locality*:—Pondichéri and Calcutta. (? Roux). *Other localities*:—Nepal; Darjiling; Kanara; Nilgiri Hills; Ceylon (B. M.); Dharwar; Kanara; Ceylon (M. S. I.) *Type*:—Leyden Museum.
6. *R. thomasi*, K. Andersen.	*Type locality*:—Karin Hills, Burma (Fea). *Other localities*:—None. *Type*:—B. M. No. 90.4.7.10. (in al.)
7. *R. ferrum-equinum tragatus*, Hodgson.	*Type locality*:—Nepal (Hodgson). *Other localities*:—Darjiling (B.M.); Sikkim (M. S. I.) *Co-types*:—B. M. Nos. 43.1.12.135-137. *Lectotype*:—B. M. No. 43.1.12.135.
8. *R. ferrum-equinum regulus*, K. Andersen.	*Type locality*:—Mussoori, U. Provinces (Hutton). *Other localities*:—Kumaon (B. M.)

Type :—B. M. No. 79.11. 21.153. (in al.)

9. *R. ferrum-equinum proximus*, K. Andersen.

Type locality :—Gilgit. (Scully.)

Other localities :—None.

Type :—B. M. No. 81.3.1. 10. (in al.)

II. *lepidus* Group.

No. 154. *minor*, Horsf.

Following Andersen, four forms are included in this group, and these may be arranged in a key as follows :—

Key to the species of the R. lepidus Group.

A.—Size large, forearm 37.5-42 mm.
  a. Larger ; nasal swelling broader ; metacarpals longer ... ... 1. *lepidus* Bly.
  b. Smaller ; nasal swellings narrower ; metacarpals shorter ... ... 2. *monticola*, K. And.
B.—Size smaller, forearm 34.2-36 mm.
  a. Sella parallel-margined ... ... 3. *gracilis*, K. And.
  b. Sella tapering ... ... 4. *subbadius*, Bly.

DISTRIBUTION :—

1. *R. lepidus*, Blyth.

Type locality :—"Calcutta?"

Other localities :—Wynaad ; Ganges Valley (B. M.); Central Provinces ; Koyna Valley ; Kanara ; Kumaon ; Bengal ; Mt. Popa (M.S.I.)

Type :—Unknown.

2. *R. monticola*, K. Andersen.

Type locality :—Mussoorie, United Provinces (Hutton).

Other localities :—Kumaon ; Chindwin (M. S. I.)

Type :—B. M. No. . 79.11. 21.151. (in al.).

3. *R. gracilis*, K. Andersen.

Type locality :—Malabar Coast.

Other localities :—None.

Type :—B. M. No. 73.4. 16.2. (in al).

4. *R. subbadius*, Blyth.

Type locality :—Nepal (Hodgson).

Other localities :—Mussoorie, United Provinces ; Garo Hills Assam (B. M.)

Type:—Ind. Mus. Calc. (No. ?) (Type of *garoensis* Dobson, Ind. Mus. Calc. No. 113a).

III. *midas* Group.

No. 155. *hipposiderus*, Bechs.	The only representative of the group.

DISTRIBUTION :—

R. hipposiderus, Bechstein.	*Type locality* :—Caspian Sea. *Other localities* :—Gilgit (B. M.) *Type* :—Unknown.

IV. *philippinensis* Group.

No. 145. *luctus*, Temm. No. 147. *trifoliatus*, Temm.	To these two species Andersen adds two more, the whole may be arranged in a key as follows :—

Key to the species of the R. philippinensis Group.

A.—Size large, forearm 71.5-78 mm ... 1. *perniger*, Hodgs.
B.—Size smaller.
  a. Size larger, forearm 63-68 mm.
    a^1. Third metacarpal (45.5-50 mm), and tail (50-55.2 mm) longer ... 2. *luctus*, Temm.
    b^1. Third metacarpal (37.5 mm), and tail (35mm) short ... ... 3. *beddomei*, K. And.
  b. Size smaller, forearm 45-56 mm. ... 4. *trifoliatus*, Temm.

DISTRIBUTION :—

1. *R. perniger*, Hodgson.	*Type locality* :—Nepal (Hodgson). *Other localities* :—Mussoorie, United Provinces; Nepal; Sikkim (B. M.); Chin Hills; Shan States (M. S. I.) *Type* :—B. M. No. 79.11.21.55.
2. *R. luctus*, Temminck.	*Type locality* :—Tapos, Java (Boie). *Other localities* :—Malay Peninsula (B. M.); Tenasserim (M. S. I.). *Type* :—Leyden Museum (Type of *morio*, Gray, B. M. No. 40.5.17.36).
3. *R. beddomei*, K. Andersen.	*Type locality* :—Wynaad, Madras (Beddome). *Other localities* :—Kanara; Coorg; Ceylon (M. S. I.). *Type* :—B. M. No. 82.3.3.1. (in al.)

4. *R. trifoliatus*, Temminck.	*Type locality* :—Bantam, Java (Hasselt). *Type localities* :—Malay Peninsula; S. W. Siam; Tenasserim (B. M.); Darjiling; Tenasserim (M. S. I.) *Type* :—Leyden Museum.

V. *macrotis* Group.

No. 149. *pearsoni*, Horsf.
No. 153. *macrotis*, Hodgs.

These two representatives of the group may be distinguished as follows:—

Key to the species of the macrotis Group.

A.—Third metacarpal shortened (656 mm)... 1. *pearsoni*, Horsf.
B.—Third metacarpal longer (703 mm) ... 2. *macrotis*, Hodgs.

DISTRIBUTION :—

1. *R. pearsoni*, Horsfield.	*Type locality* :—Darjiling (Pearson). *Other localities* :—Kumaon; Darjiling (M. S. I.). *Type* :—B. M. No. 79.11.21.56.
2. *R. macrotis*, Hodgson.	*Type locality* :—Nepal (Hodgson). *Other localities* :—Mussoorie, United Provinces, Nepal (B. M.). *Type* :—B. M. No. 45.1.8.416.

VI. *arcuatus* Group.

No. 146. *cœlophyllus*, Pet.

This is the solitary representative of the Group within our limits.

DISTRIBUTION :—

R. cœlophyllus, Peters.	*Type locality* :—Salween River, Burma (Capt. Beavan). *Other localities* :—Malay Peninsula; Moulmein, Lower Burma; Tsagine, Upper Burma (B. M.). *Type* :—Berlin Museum.

NOTE :—With reference to Blanford's No. 148, *mitratus*, Blyth. Dr. Andersen informs me that he has examined the co-types (Ind. Mus. Calc. Nos. 105 a. and b.), which were taken by Tickell at Chaibassa, Orissa, in 1843, and they are in such bad condition that it is impossible to discover with any certainty even the affinities of the species. The animal has never again been taken. Under the circumstances I have omitted *mitratus* altogether from the above review of the genus.

Gen. 11.—HIPPOSIDEROS.

No. 159. *armiger*, Hodgs.
No. 161, *diadema*, Geoff.

These two species form the first section of Blanford's key to the genus, but *diadema* does not occur in our area, on the other hand, Andersen has revived *lankadiva*, Kelaart, to contain the bats included in *diadema* by Blanford, and Thomas has established a species for a bat from S. W. Siam, which proves to occur within our limits, and finally Andersen has provided a subspecific name *debilis* (A. M. N. H. 7, xvii, p. 37, 1906), for the southern race of *armiger*.

No. 158. *tridens*, Geoff.
No. 160. *leptophyllum*, Dobs.
No. 162. *nicobarensis*, Dobs.
No. 163. *galeritus*, Cant.
No. 164. *speoris*, Schneid.
No. 165. *larvatus*, Horsf.
No. 166. *bicolor*, Gray.
No. 167. *amboinensis*, Pet.

These eight species make up the rest of Blanford's key. In my reports I used *fulvus*, Gray, and *dukhunensis*, Sykes, for *bicolor* and *speoris* respectively (J. B. N. H. S., xxi, pp. 1178 and 1179, 1912), I am now advised that *fulvus* should be retained but that there is not sufficient reason to substitute *dukhunensis* for *speoris*. The species *galeritus* does not seem to occur within our limits and therefore the name *brachyotus*, Dobson, should be substituted for it. Finally true *tridens* does not come into our area, where it is represented by a subspecies *tridens murriana*, K. Andersen. The species as thus modified may be arranged in a key as follows:—

Key to the species of HIPPOSIDEROS.

A.—Size large, forearm 78-97mm.
- *a*. A large frontal glandular sac; posterior leaf narrower than horseshoe.
  - a^1. Size larger, forearm 84 mm. and upwards... ... ... 1. *armiger*, Hodgs.
  - b^1. Size smaller, forearm about 78 mm. 2. *lylei*, Thos.
- *b*. No frontal sac; posterior leaf not narrower than horseshoe ... ... 3. *lankadiva*, Kel.

B.—Size small, forearm less than 75 mm.
- *a*. Posterior margin of nose-leaf terminating in three sharp points; forearm 44 mm ... ... 4. *tridens murraiana*, And.
- *b*. Posterior margin of nose-leaf rounded.
  - *a'* Supplementary leaflets on each side of the horseshoe.
    - *a*. Three leaflets on each side

a. Surface of posterior noseleaf divided into two cells; forearm 65 mm ... ... 5. *nicobarensis*, Dobs.

b. Surface of posterior cell divided to four cells.

a. Posterior leaf narrower than horseshoe; forearm 61 mm. ... ... 6. *leptophyllus*, Dobs.

b. Posterior leaf as wide as horseshoe or wider.

a. Hinder margin of interfemoral membrane straight; forearm 50 mm. ... ... 7. *speoris*, Schneid.

b. Hinder margin of interfemoral membrane a salient angle; forearm 56 mm. ... ... 8. *larvatus*, Horsf.

b. Two leaflets on each side; forearm 44 mm. ... ... 9. *brachyotus*, Dobs.

*b*¹. No supplementary leaflets.

a. Ears laid forwards extend to muzzle; forearm 39 mm ... 10. *fulvus*, Gray.

b. Ears laid forwards do not extend to muzzle; forearm 35 mm ... 11. *amboinensis*, Pet.

DISTRIBUTION :—

1. *H. armiger*, Hodson.

Type locality :—Nepal (Hodgson).

Other localities :—Khasia Hills (B. M.); Kumaon; Darjiling; Chin Hills; Chindwin; Shan States; Mt. Popa (M. S. I.)

Co-types :—B. M. Nos. 43.1.12.132. and 133. (Type of *debilis*, K. Andersen, B. M. No. 79.11.21.80).

Lectotype :—B. M. No. 43.1.12.132.

2. *H. lylei*, Thomas.

Type locality :—Chiengmai, N. Siam. (Lyle).

Other localities :—Shan States (M. S. I.)

Type :—B. M. No. 13.4.18.3.

3. *H. lankadiva*, Kelaart.	*Type locality* :—Kandy, Ceylon (Kelaart). *Other localities* :—Central Provinces ; Kanara ; Bellary ; Mysore (M. S. I.) *Co-types* :—B. M. Nos 52.5.9.11 & 7.1.1.311. *Lectotype* :—B. M. No. 7.1.1.311.
4. *H. tridens murraiana*, Andersen.	*Type locality* :—Karachi, Sind (? Murray). *Other localities* :—None. *Type* :—Ind. Mus. Calc. No. 121 hh.
5. *H. nicobarensis*, Dobson.	*Type locality* :—Nicobars (Stoliczka). *Other localities* :—None. *Type* :—Ind. Mus. Calc. No. 127 a.
6. H. *leptophyllus*, Dobson.	*Type locality* :—Khasi Hills, Assam (Godwin Austen.) *Other localities* :—None. *Type* :—Ind. Mus. Calc. No. 125a.
7. *H. speoris*, Schneider.	*Type locality* :—" Timor and Amboina ". *Other localities* :—Dharwar ; Trincomali, Ceylon (B. M.); Dharwar ; Kanara ; Bellary ; Mysore ; Coorg ; Ceylon (M. S. I.) *Type* :—Unknown. (Co-types of *aureus*, Kelaart, B. M. Nos. 52.5.9. 3 & 4 & 5 ; Co-types of *templetoni*, Kelaart, B. M. Nos. 52.1.24.2 & 3 & 4 ; Type of *apiculatus*, Gray, B. M. No. 19.a.b.c.d.f. ; Type of *penicillatus*, Gray, B. M. No. 19e.)
8. *H. larvatus*, Horsfield.	*Type locality* :—Java (Horsfield). *Other localities* :—Chindwin ; Shan States ; Mt. Popa (M. S. I.) *Type* :—B. M. No.79.11.21.93.
9. *H. brachyotus*, Dobson.	*Type locality* :—Central India. (Staples). *Other localities* :—Palanpur ; Kanara ; Ceylon ; Bengal (M. S. I.) *Type* :—B. M. No. 9.1.4.70. (in al.).
10. *H. fulvus*, Gray.	*Type locality* :—Dharwar (Elliot). *Other localities* :—Sind ; " Bombay "; Madras (Jerdon) ; Ceylon ;

Upper Burma (B. M.); Palanpur; Kathiawar; Cutch; Central Provinces; Western Ghats; Dharwar; Kanara; Bellary; Mysore; Ceylon; Sikkim; Darjiling; Bhutan Duars; Bengal; Chindwin; Shan States, Mt. Popa; Tenasserim (M. S. I.)

Type :—B. M. No. 22a.

11. *H. amboinensis*, Peters. *Type locality* :—Amboina.

Other localities :—"Dekhan" (B. M.)

Type :—Berlin Museum.

Gen. III. COELOPS.

No. 168, *frithi*, Bly. The only species of the genus.

DISTRIBUTION :—

C. frithi, Blyth. *Type locality* :—Sundarbans, Bengal (Frith).

Other localities :—None.

Type :—Ind. Mus. Calc. No. 132a.

Family III.—MEGADERMATIDÆ.

In 1907 Dr. Andersen and I made a study of the material available in this Family (A. M. N. H. (7), xix., p. 129, 1907) when we decided to revive the genus EUCHEIRA to contain the species *lyra*, Geoffroy. Later it was found that the name was pre-occupied in Entomology, so that the next oldest name, LYRODERMA must be substituted for it. These two genera may be distinguished as follows :—

Key to the genera of the MEGADERMATIDÆ.

A.—Posterior termination of nose-leaf rounded. I. MEGADERMA.
B.—Posterior termination of nose-leaf truncated. II. LYRODERMA.

Gen. I.—MEGADERMA.

No. 170. *spasma*, L. Further we found (l. c. *supra.*) that true *spasma*, L., must be limited to the Celebes and Philippines, and that the subspecific name *trifolium*, must be used for the Indian form.

DISTRIBUTION :—

M. spasma trifolium, Geoffroy. *Type locality* :—Java. (Leschenault).

Other localities :—Western India; Ceylon; S. W.; Siam (B. M.); Dharwar; Kanara; Coorg; Ceylon; Chindwin; Mt. Popa; Pegu; Tenasserim (M. S. I.)

Type:—Unknown. Perhaps in Paris Museum. (Type of *horsfieldi*, Blyth, B. M. No. 60.5.4.13.)

Gen. 11.—LYRODERMA.

No. 169. *lyra*, Geoff. Besides removing *lyra* to this genus, we established a subspecies *caurina*, for the specimens from the West Coast of India which may be distinguished from true *lyra* as follows:—

Key to the subspecies of M. lyra.

A.—On the average larger, forearm 65-69 mm ... ... 1. *lyra lyra*, Geoff.
B.—On the average smaller, forearm 63-64 mm ... ... 2. *lyra caurina*, A. & W.

DISTRIBUTION:—

1. *L. lyra lyra*, Geoffroy. *Type locality*:—East Coast of Madras?

Other localities:—Secunderabad; Bengal (B. M.); Palanpur; Khandesh; Central Provinces; Bellary; Mysore; Kumaon; Bengal; Sikkim: Bhutan Duars; Shan States (M. S. I.)

Type:—Unknown. Perhaps in Paris Museum.

2. *L. lyra caurina*, Andersen & Wroughton. *Type locality*:—Surat District (Wroughton).

Other localities:—Western Ghats; Dharwar; Kanara (M. S. I.)

Type:—B. M. No. 98.4.2.2.

Family IV.—NYCTERIDÆ.

There is only one genus.

Gen. NYCTERIS.

javanica, Geoff. Though not included in his list, Blanford mentions this species as occurring in the Malay Peninsula (Mamm., p. 295), but Dr. Andersen has separated these northern specimens under the name *tragata* (A. M. N. H. S., x, p. 546, 1912).

DISTRIBUTION:—

N. tragata, K. Andersen. *Type locality*:—Sarawak, Borneo (C. J. Brooks).

Other localities:—Malay Peninsula (B. M.); Tenasserim (M. S. I.)
Type:—B. M. No. 3.3.31.1.(in al.)

Family V.—VESPERTILIONIDÆ.

Blanford ranged all the species of VESPERTILIONIDÆ in eight genera, but the increase in the number of genera and species since his work was done is so great that it would only cause confusion to try and give equivalents for his genera, I propose therefore to ignore them altogether and to maintain touch with him only through his numbered species. The latest work on the classification of the CHIROPTERA is Miller's "The Families and Genera of Bats", 1907, which I have here followed as closely as possible so far as it deals with our fauna. Miller recognises four subfamilies of the VESPERTILIONIDÆ, which may be arranged in a key as follows:—

Key to the subfamilies of the VESPERTILIONIDÆ.

A.—Nostrils elongated, tubular ... II. MURINÆ.
B.—Nostrils not elongated.
  a.—Ears funnel-shaped ... ... III. KERIVOULINÆ.
  b. —Ears not funnel-shaped.
    *a*¹.—Second phalanx of third finger nearly three times as long as first ... ... IV. MINIOPTERINÆ.
    *b*¹.— Second phalanx of third finger not elongated ... ... I. VESPERTILIONINÆ.

Subfamily I.—VESPERTILIONINÆ.

In this subfamily Miller recognised 16 Genera (two of them by different names to those used here), which may be arranged in a key as follows:—

Key to the Genera of the VESPERTILIONINÆ.

A.—Cheek teeth six, on each side, above and below.
  a. Feet large ... ... XVI. LEUCONOE.
  b. Feet normal ... ... XV. MYOTIS.
B.—Cheek teeth less than six on each side above and below.
  a. Upper premolars 2-2.
    *a*¹ Lower premolars 3-3 ... ... II. PLECOTUS.
    *b*¹ Lower premolars 2-2.
      *a*². Outer, upper incisor not extending beyond cingulum of inner. XI. SCOTOZOUS.
      *b*². Outer, upper incisor extending distinctly beyond cingulum of inner.

a^3. 5th finger only a little longer than metacarpal of 4th and 3rd ... ... VII NYCTALUS.
b^3. 5th finger longer than metacarpal and 1st phalanx of 4th and 3rd.
a^4. Upper surface of rostrum concave ; ears joined ... I. BARBASTELLA.
b^4. Upper surface of rostrum convex ; ears separate.
a^5. Outer upper incisor normal in position, its concavity directed backwards ... ... VIII. PIPISTRELLUS.
b^5. Outer upper incisor pushed outwards from its normal position, the concavity directed outwards ... ... IX. GLISCHROPUS.
b. Upper premolars 1-1.
a^1. Upper incisors 2-2.
a^2. Skull noticeably flattened ; soles of feet expanded into fleshy pads. VI. TYLONYCTERIS.
b^2. Skull not noticeably flattened ; soles of feet normal.
a^3. Outer upper incisor large, crowded inward between inner incisor and canine ... ... X. HESPEROPTENUS.
b^3. Outer upper incisor small, on outer side of inner incisor and separated from canine.
a^4. Rostrum evenly convex laterally ; palatal emargination deeper than broad ... VI. EPTESICUS.
b^4. Rostrum noticeably concave on each side of middle line ; palatal emargination broader than deep ... V. VESPERTILIO.
b^1. Upper incisors 1-1.
a^2. Ears noticeably enlarged ... III. OTONYCTERIS.
b^2. Ears not noticeably enlarged.
a^3. 1st and 2nd upper molars with "W" pattern distorted or nearly absent ... ... XII. SCOTOPHILUS.
b^3. 1st and 2nd upper molars with "W" pattern not distorted.

a^4. Depth of maxillary emargination equal to distance between canines ... XIII. SCOTEINUS.

b^4. Depth of maxillary emargination scarcely more than half the distance between canines ... ... XIV. SCOTOMANES.

Gen. I. BARBASTELLA. Blanford uses the name SYNOTUS for this Genus.

No. 172. *darjelingensis*, Hodgs. The sole species.

DISTRIBUTION :—

B. darjelingensis, Hodgson. *Type locality* :—Nepal (Hodgson). *Other localities* :—Murree; Rajputana (B. M.); Darjiling; Bhutan Duars (M. S. I.).

Type :—B. M. No. 54.9.1.13.

Gen. II.—PLECOTUS.

No. 171, *auritus*, L. Hodgson gave the name *homochrous* to the Nepal form (J. B. N. H. S., xxiii., p. 288, 1914). Barrett Hamilton described a species *puck* from the Punjab, (A. M. N. H. (7) xx. p. 521. 1907) and Thomas another, *wardi*, from Ladak. (A. M. N. H. (8) vii. p. 289, 1911). These may be arranged in a key as follows :—

Key to the species of PLECOTUS.

A.—Size smaller, forearm 40 mm or less; colour darker.

a. Size larger, forearm 40 mm ... ... 1. *homochrous*, Hodgs.

b. Size smaller forearm 38 mm ... ... 2. *puck*, B. Ham.

B.—Size larger, forearm 43 mm; colour paler. 3. *wardi*, Thos.

DISTRIBUTION :—

1. *P. homochrous*, Hodgson. *Type locality* :—Nepal (Hodgson). *Other localities* :—Kumaon (M.S.I.).

Type :—B. M. No. 54.9.1.1.

2. *P. puck*, Barrett Hamilton. *Type locality* :—Murree, Punjab (Birrell).

Other localities :—None.

Type :—B. M. No. 5.11.19.1.

3. *P. wardi*, Thomas. *Type locality* :—Leh, Ladak (Ward-Crump).

Other localities :—None.

Type :—B. M. No. 6.10.3.2.

NOTE:—There is some doubt whether *homochrous* and *puck* are really separable but with such poor material a confident decision is impossible. Series of these long-eared bats are a great desideratum.

Gen. III.—OTONYCTERIS.

No. 173. *hemprichi*, Pet. The sole Indian representative of the Genus.

DISTRIBUTION :—

O. hemprichi, Peters. *Type locality* :—N. E. Africa.
Other localities :—Gilgit (Biddulph) (B.M.)
Type :—Berlin Museum.

Gen. IV.—EPTESICUS.

No. 174. *serotinus*, Sschreb.
No. 175. *nasutus*, Dobs.
No. 176. *borealis*, Nils.
No. 178. *atratus*, Blyth.
No. 179. *pachyotis*, Dobs.

Substituting *pachyomus*, Tomes's name for the Indian form of *serotinus*, these five species may be arranged in a key as follows :—

Key to the species of EPTESICUS.

A.—No thickened base to ear.
  a. Size larger, forearm 50 mm or more... 1. *pachyomus*, Tomes.
  b. Size smaller, forearm less than 50 mm.
    *a*¹. No postcalcaneal lobe; forearm 36 mm. ... ... 2. *nasutus*, Dobs.
    *b*¹. A postcalcaneal lobe present.
      *a*². Ears much shorter than the head; forearm 38 mm. ... 3. *borealis*, Nils.
      *b*². Ears nearly as long as head; forearm 42 mm. ... ... 4. *atratus*, Blyth.
B.—Base of ear thickened; forearm 40 mm. 5. *pachyotis*, Dobs.

DISTRIBUTION :—

1. *E. pachyomus*, Tomes. *Type locality* :—Rajputana (Boys).
Other localities :—Kashmir (B. M.)
Type :—B. M. No. 48. 2.18.7. Co-types of *andersoni*, Dobson, Ind. Mus. Calc. No. 141. a. & b.

2. *E. nasutus*, Dobson. *Type locality* :—Shikarpur. Sind (Blanford).
Other localities :—None.
Type :—Ind. Mus. Calc. No. 142.a

3. *E. borealis*, Nilsson. *Type locality* :—Scandinavian Peninsula.
Other localities :—Gilgit (Scully)
Type :—Unknown.

4. *E. atratus*, Blyth. *Type locality* :—Darjiling (Stoliczka)
Other localities :—None.
Co-types :—Ind. Mus. Calc. 143. a. & b.

5. *E. pachyotis*, Dobson. *Type locality* :—Khasi Hills, Assam (Bourne).
Other localities :—None.
Co-types :—Ind. Mus. Calc. No. 145. a. & b.

Gen. V.—VESPERTILIO.

Blanford uses the name in quite a different sense.

No. 177. *discolor*, Natt. The name *murinus*, L., is now generally accepted for this species, which appears to be identical with the European form, and which scarcely enters our area.

DISTRIBUTION :—

V. murinus, Linnæus. *Type locality* :—Northern Europe.
Other localities :—Gilgit (Scully).
Type :—Unknown.

Gen. VI.—TYLONYCTERIS.

No. 180, *pachypus*, Temm. Temminck's name is that of the Java form. Recently Thomas made an attempt to assign these bats to several existing species but further specimens received later did not altogether support his conclusions and it was decided (J. B. N. H. S., xxiv., p. 778, 1916) to use *fulvida*, Blyth, for all Indian animals except those from the West Coast, for which Thomas has provided the name *aurex* (A. M. N. H. S., xv, p. 228, 1915). These two forms may be distinguished as follows :—

Key to the species of TYLONYCTERIS.

A.—Colour darker, deep rufous ... ... 1. *fulvida* Blyth.
B.—Colour paler, brownish gold ... ... 2. *aurex*, Thos.

DISTRIBUTION :—

1. *T. fulvida*, Blyth.	*Type locality* :—Shwe Gayen, Burma. (Maj. Berdmore). *Other localities* :—Manipur (B. M.); Sikkim; Darjiling; Chin Hills; Chindwin; Shan States; Pegu; Tenasserim (M. S. I.). *Co-types* :—Ind. Mus. Calc. No. 146. a-e.
2. *T. aurex*, Thomas.	*Type locality* :—Belgaum (Wroughton). *Other localities* :—Sirsi, Kanara (B. M.) Dharwar; Kanara; Coorg (M. S. I.). *Type* :—B. M. No. 0.4.2.15.

Gen. VII.—NYCTALUS.

No. 181. *noctula*, Schreb.
No. 182. *leisleri*, Kuhl.

Schreber's species is the European form, Hodgson gave the name *labiatus* to the Indian one and Thomas has recently added a third species. These may be arranged, by size, as follows :—

Key to the species of NYCTALUS.

A.—Large, forearm 50 mm. or more ...	1. *labiatus*, Hodgs.
B.—Small, forearm 41 mm. or under.	
a.—Forearm 41 mm.	2. *leisleri*, Kuhl.
b.—Forearm 39 mm.	3. *joffrei*, Thomas.

DISTRIBUTION :—

1. *N. labiatus*, Hodgson.	*Type locality* :—Nepal (Hodgson). *Other localities* :—Kashmir (B. M.); Kalimpong, Darjiling; Chin Hills (M. S. I.). *Type* :—B. M. No. 43.1.12.146.
2. *N. leisleri*, Kuhl.	*Type locality* :—Hanau, Germany. *Other localities* :—Murree, Punjab; Mussoorie (Hutton) (B. M.). *Type* :—Unknown.
3. *N. joffrei*, Thomas.	*Type locality* :—Chin Hills (Mackenzie). *Other localities* :—Chin Hills (M. S. I.). *Type* :—B. M. No. 16.3.26.2.

Gen. VIII.—PIPISTRELLUS.

No. 183. *mordax*, Pet.
No. 184. *affinis*, Dob.
No. 185. *circumdatus*, Temm.
No. 186. *ceylonicus*, Kel.
No. 187. *abramus*, Temm.
No. 188. *pipistrellus*, Schreb.
No. 189. *kuhli*, Natt.
No. 190. *annectens*, Dobs.

The Indian representative of *abramus*, Temm. (which is a Japanese species) is *coromandra*, Gray. I established a species *mimus*, for a dwarf form of *coromandra*, (J. B. N. H. S., xii., p. 722, 1900), and later a subspecies of it, *glaucillus*, (J. B.N.H.S., XXI., p. 768, 1912). Thomas has made several new species, *viz.*, *lophurus*, *cadornæ*, *shanorum*, *babu*, and *paterculus*, on specimens obtained by the Survey, and has recognised four subspecies of Kelaart's *ceylonicus* (J. B. N. H. S., xxiii, p. 413, 1915). This raises the number of recognised forms to 20, which may be arranged in a key as follows :—

Key to the species of PIPISTRELLUS.

A.—Size large, forearm about 40 mm.

a. Tragus very broad, about 4mm; colour black and hoary; forearm 40mm ... 1. *mordax*, Pet.

b. Tragus narrower.

a^1. Tragus pointed above; forearm 40 mm. ... ... 2. *annectens*, Dobs.

b^1. Tragus rounded at tip.

a^2. Colour black; forearm 41 mm. ... 3. *circumdatus*, Temm.

b^2. Colour brown.

a^3. Outer upper incisors acutely pointed; forearm 39 mm. ... 4. *affinis*, Dobs.

b^3. Outer upper incisors hollowed to receive lower canine.

a^4. Skull smaller and slighter; anterior premolar smaller; forearm 37 mm. ... 5. *shanorum*, Thos.

b^4. Skull larger and stouter; anterior premolar larger.

a^5. Colour brown.

a^6. Smaller.

a^7. Colour darker, forearm 37 mm. ... 6. *ceylonicus ceylonicus*, Kel.

b^7. Colour paler, forearm 37 mm. ... 7. *c. chrysothrix*. Wr.

b^6. Larger, forearm 40 mm. ... ... 8. *c. indicus*. Dobson.

b^5. Colour grey, forearm 38 mm. ... ... 9. *c. subcanus*, Thomas

B.—Size small, forearm about 35 mm. or less.

a. Size larger, forearm about 35 mm.

a^1. A dorsal gland at root of tail, forearm 35 mm. ... ... 10. *lophurus*, Thomas.

b^1. No dorsal gland.

a^2. Interfemoral membrane edged with white, forearm 35 mm.

a. Colour darker ... ... 11. *kuhli kuhli*, Natterer.

b. Colour paler ... ... 12. *kuhli lepidus*, Blyth.

b^2. Interfemoral membrane not edged with white, forearm 35 mm. ... ... 13. *babu*, Thomas.

b. Size smaller, forearm 33 mm. or less.

a^1. Tragus very broad, about 4 mm.; forearm 33 mm.

a^2. Colour rich brown ... ... 14. *cadornæ*, Thos.

b^2. Colour black, hoary ... ... 15. *austenianus*, Dobs.

b^1. Tragus narrower.

a^2. Outer margin of ear, below tip, concave; forearm 31 mm. ... 16. *pipistrellus*, Schreb.

b^2. Outer margin of ear, below tip, straight.

a^3. Anterior premolar not entirely inside the tooth row: interior incisor not reaching as high as outer cusp of outer incisor; forearm 31·5 mm. ... ... 17. *paterculus*, Thos.

b^3. Anterior premolar entirely inside tooth row; interior incisor reaching higher than outer cusp of outer incisor.

a^4. Skull longer (12·5 mm.): tooth row longer: forearm 29-33 mm. ... 18. *coromandra*, Gray.

b^4. Skull shorter (11·5 mm.): tooth row shorter; forearm 27-29 mm.

a^5. Colour bistre brown ... 19. *mimus mimus*, Wr.

b^5. Colour mouse grey ... 20. *m. glaucillus*, Wr.

DISTRIBUTION :—

1. *P. mordax*, Peters.	*Type locality* :—Java. *Other localities* :—Kumaon ; Calcutta (B. M.) ; Darjiling (M. S. I.). *Type* :—Berlin Museum.
2. *P. annectens*, Dobson.	*Type locality* :—Naga Hills, Assam (Capt. Butler). *Other localities* :—None. *Type* :—Ind. Mus. Calc. No. 155a.
3. *P. circumdatus*, Temminck.	*Type locality* :—Java. *Other localities* :— "India" (Jerdon) (B. M.). *Type* :—Leyden Museum.
4. *P. affinis*, Dobson.	*Type locality* :—Bhamo, Upper Burma (W. Yunnan Exped.—Anderson). *Other localities* :—None. *Type* :—Ind. Mus. Calc. No. 151a.
5. *P. shanorum*, Thomas	*Type locality* :—Pyaung-gaung, N. Shan States. (B. N. H. S.—Shortridge.) *Other localities* :—Shan States (M.S.I.). *Type* :—B. M. No. 14.7.8.6.
6. *P. ceylonicus ceylonicus*, Kelaart.	*Type locality* :—Ceylon (Kelaart). *Other localities*:—Panduloya, Ceylon (B. M.). *Type* :—Lost.
7. *P. ceylonicus indicus*, Dobson.	*Type locality* :—Mangalore, Malabar Coast (Dobson). *Other localities* :—Ratnagiri ; Belgaum ; Kanara (B. M.) ; Kanara Coorg (M.S.I.) *Type* :—B. M. No. 9.1.4.73.
8. *P. ceylonicus chrysothrix*, Wroughton.	*Type locality* :—Mheskatri, Surat Dangs (Wroughton). *Other localities* :—Bulsar ; Surat Dist.; Nawapur, Khandesh ; Bombay ; Poona ; Satara ; Dharwar (B. M.); Khandesh ; Berars ; Satara ; Dharwar ; Mysore ; Bengal (M. S. I.). *Type* :—B. M. No. 98.5.5.3.

9. *P. ceylonicus subcanus*, Thomas.	*Type locality*:—Junagadh State, Kathiawar. (B. N. H. S.—Crump.) *Other localities*:—Sind; Cutch; Palanpur (M.S.I.). *Type*:—B. M. No. 13.8.8.30.
10. *P. lophurus*, Thomas.	*Type locality*:—Maliwun, S. Tenasserim (B. N. H. S.—Shortridge). *Other localities.*—None. *Type.*—B. M. No. 14.12.1.6.
11. *P. kuhli kuhli*, Natterer.	*Type locality*:—Trieste, Austria-Hungary. *Other localities*:—Khairpur, Sind (M. S. I.). *Type*:—Unknown. (Co-types of *canus*, Blyth, Ind. Mus. Calc. Nos. 154. a. and b.; Type of *leucotis* Dobson, Ind. Mus. Calc. No. 154. p.)
12. *P. kuhli lepidus*, Blyth.	*Type locality*:—Kandahar (Hutton.) *Other localities*:—Kashmir. Upper Sind Frontier (M. S. I.). *Type*:—Unknown.
13. *P. babu*, Thomas.	*Type locality*:—Murree, 8,000′, Punjab (Maj. Dunn). *Other localities*:—Garial, Punjab: Mussoorie (Hutton); Simla; Nepal (Hodgson); Darjiling (Blyth); Sylhet (B. M.); Central Provinces; Darjiling; Bhutan Duars (M. S. I.) *Type*:—B. M. No. 7.11.21.2.
14. *P. cadornæ*, Thomas.	*Type locality*:—Pashok, 3,500′. Darjiling (B. N. H. S.—Baptista). *Other localities*:—None. *Type*:—B. M. No. 16.3.25.6.
15. *P. austenianus*. Dobson.	*Type locality*:—Cherrapunji. Assam (Godwin-Austen). *Other localities*:—Shan States (M. S. I.). *Type*:—Ind. Mus. Calc. No. 150.b.
16. *P. pipistrellus*. Schreber.	*Type locality*:—France.

	Other localities:—No Indian specimen in B. M. *Type* :—Unknown.
17. *P. paterculus*, Thomas.	*Type locality* :—Mt. Popa, Burma. (B. N. H. S.—Shortridge.) *Other localities* :—Chindwin ; Shan States ; Mt. Popa (M. S. I.). *Type* :—B. M. No. 14.7.19.242.
18. *P. coromandra*, Gray.	*Type locality*:—Coromandel Coast. *Other localities* :—Surat ; Bombay ; Ratnagiri (B. M.) ; Dharwar ; Mysore ; Coorg ; Ceylon ; Kumaon ; Bengal ; Sikkim ; Darjiling ; Bhutan Duars (M. S. I.). *Type* :—Unknown. Perhaps in Paris Museum (the name is a renaming of F. Cuvier's *Vespertilio de Coromandel*).
19. *P. mimus mimus*, Wroughton.	*Type locality* :—Mheskatri, Surat Dangs (Wroughton). *Other localities* :—Surat; Khandesh ; Poona (B.M.) ; Cutch ; Palanpur ; Kathiawar ; Khandesh ; Berars; Central Provinces ; Dharwar ; Kanara ; Bellary ; Mysore ; Coorg : Ceylon ; Kumaon ; Bengal ; Sikkim ; Bhutan Duars ; Chin Hills ; Chindwin (M. S. I.). *Type* :—B. M. No. 98. 5.5.6.
20. *P. mimus glaucillus*, Wroughton.	*Type locality* :—Multan, Punjab (Maj. Dunn). *Other localities* :—Sind (M. S. I.). *Type* :—B. M. No. 10.1.18.15.

Gen. IX.—GLISCHROPUS.

Though Blanford does not mention this bat in the body of his work, he refers to it, under the name *Vesperugo tylopus*, Dobson, in the appendix (Mamm., p. 602). I can find no mention otherwise within our area, though Thomas has recorded it from Perak (Journ. F. M. S. Mus., vii., p. 2, 1916).

DISTRIBUTION :—

G. tylopus, Dobson.	*Type locality* :—Northern Borneo. *Other localities* :—Biapo, Karennee, (Thomas-Fea.) *Type* :—B. M. No. 71.2.10.2.

Gen. X.—HESPEROPTENUS.

No. 191. *tickelli*, Blyth.
No. 192. *blanfordi*, Dobs.

These two species can be easily separated by size. Section C of Blanford's key may therefore be adopted as it stands, *viz.* :—

Key to the species of HESPEROPTENUS.

A.—Size large, forearm 53 mm. ... ... 1. *tickelli*, Blyth.
B.—Size small, forearm 28 mm. ... ... 2. *blanfordi*, Dobs.

DISTRIBUTION :—

1. *H. tickelli*, Blyth.

Type locality :—Chaibassa, "Central India" (Tickell).

Other localities :—Rajputana ; Thana District, Bombay ; Kanara ; Madras (Jerdon) (B. M.) ; Dharwar ; Kanara ; Ceylon ; Bengal ; Bhutan Duars (M.S.I.)

Co-types :—Ind. Mus. Calc. No. 156. a. b. and c.

2. *H. blanfordi*, Dobson.

Type locality :—Tenasserim.

Other localities :—Malay Peninsula (B. M.)

Type :—Ind. Mus. Calc. No. 157. a.

Gen. XI.—SCOTOZOUS.

No. 193. *dormeri*, Dobs.

Thomas lately, in providing a new subspecies for the Northern form of *dormeri*, i.e., *caurinus*, decided to follow Miller and accept SCOTOZOUS as a full genus (J. B. N. H. S., xxiv., p. 33. 1915). These two forms may be distinguished as follows :—

Key to the forms of SCOTOZOUS.

A.—Skull and teeth rather smaller ; colour brown ... ... 1. *d. dormeri*, Dobs.
B.—Skull and teeth rather larger ; colour hoary grey ... ... 2. *d. caurinus*, Thos.

DISTRIBUTION :—

1. *S. dormeri dormeri*, Dobson.

Type locality :—Bellary Hills, Southern India (Dormer).

Other localities :—Berars (Blanford) : Surat and Konkan ; Bombay (B. M.) : Khandesh ; Berars ; Central Provinces ; Dharwar ; Bellary ; Bengal ; Bhutan Duars (M. S. I.)

Type :—B. M. No. 65.5.20.3.

2. *S. dormeri caurinus*, Thomas.

Type locality:—Junagadh State, Kathiawar, (B.N.H.S.—Crump).

Other localities:—Cutch; Kathiawar; Palanpur (M. S. I.)

Type:—B. M. No. 13.8.8.32.

Gen. XII.—SCOTOPHILUS.

No. 194. *kuhli*, Leach.

This is the only species in Blanford's work which comes into the genus SCOTOPHILUS as now accepted. The species *heathi* and *castaneus*, included by him in the synonymy of *kuhli*, must be revived to represent the forms of South India and Tenassarim, respectively, while Thomas has added a species *wroughtoni*. (J. B. N. H. S., xi., p. 274, 1897). These four forms may be arranged in a key as follows:—

Key to the species of SCOTOPHILUS.

A.—Size large, forearm 65 mm. ... ... 1. *heathi*, Horsf.
B.—Size smaller.
  a. Size larger, forearm 58-62 mm. ... 2. *kuhli*, Leach.
  b. Size smaller, forearm 50 mm.
    *a*¹. Colour chestnut above and below. 3. *castaneus*, Horsf.
    *b*¹. Colour almost white below ... 4. *wroughtoni*, Thos.

DISTRIBUTION:—

1. *S. heathi*, Horsfield.

Type locality:—"Madras" (Heath).

Other localities:—Rajputana (Boys) (B. M.)

Co-types:—B. M. No. 7.1.1. 446 & 447.

Lectotype:—B. M. No. 7.1.1. 446.

2. *S. kuhli*, Leach.

Type locality:—Unknown.

Other localities:—Khandesh; Sehore, C. I. (Whitehead); Ajunta Caves; Dekhan (Sykes); Surat; Thana; Kanara; Travancore; Trichinopoly; Ceylon (Layard); Bengal; Malay; Siam (B.M.) Sind; Cutch; Palanpur; Khandesh; Central Provinces; Mysore; Kanara; Kumaon; Ben-

	gal; Sikkim; Bhutan Duars; Chin Hills; Chindwin; Mt. Popa; Shan States. *Type* :—B. M. not registered. No. a. of Dobson's catalogue.
3. *S. castaneus*, Horsfield.	*Type locality* :—Malacca. *Other localities* :—Malay Peninsula; Siam (B. M.); Tenasserim (M. S. I.) *Type* :—B. M. No. 79.11,21. 116.
4. *S. wroughtoni*, Thomas.	*Type locality* :—Kim, Surat, (Wroughton). *Other localities* :—Surat, Khandesh, Thana, Poona, Satara Districts, Bombay (B. M.), Palanpur; Kathiawar; Khandesh; Central Provinces; Dharwar; Kanara; Mysore; Coorg; Ceylon; Bengal; Kumaon; Sikkim, Bhutan Duars; Mt. Popa (M.S.I.) *Type* :—B. M. No. 97.6.8. 12.

Gen. XIII.—SCOTEINUS.

No. 195. *emarginatus*, Dobs. No. 196. *pallidus*, Dobs.	These two species, the only ones found within our area, are easily distinguished by size as follows :—

Key to the species of SCOTEINUS.

A.—Larger, forearm 55 mm. ... ... 1. *emarginatus*, Dobs.
B.—Smaller, forearm 35 mm. ... ... 2. *pallidus*, Dobs.

DISTRIBUTION :—

1. *S. emarginatus*, Dobson.	*Type locality* :—" India." *Other localities* :—None. *Type* :—Ind. Mus. Calc. No. 160. a. (in al.)
2. *S. pallidus*, Dobson.	*Type locality* :—Mian Mir, Punjab (J. S. Gunn). *Other localities* :—Northern Sind Frontier (M. S. I.). *Type* :—Ind. Mus. Calc. No. 161. a.

Gen. XIV.—SCOTOMANES.

No. 197. *ornatus*, Blyth. The only species.

DISTRIBUTION :—

S. ornatus, Blyth.

Type locality :—Darjiling.

Other localities :—China ; Sikkim (B. M.) ; Sivok, Bengal (M. S. I.).

Type :—Ind. Mus. Calc. No. 162. a.

Gen. XV.—MYOTIS.

Thomas has recently advocated the separation in a distinct genus, LEUCONOE, of the species with abnormally large feet. (J. B. N. H. S., xxiii, p. 607, 1915).

No. 207. *nepalensis*, Dobs.
No. 208. *murinus*, L.
No. 209. *dobsoni*, Trouess.
No. 210. *formosus*, Hodgs.
No. 211. *mystacinus*, Leisl.
No. 212. *muricola*. Hodgs.

Miller in his "Mammals of Western European" 1912, placed *murinus* as a synonym of *myotis*, and Thomas (l.c.) indicated *blythii*. Tomes, as the Indian representative of *myotis*. Both Blanford and Thomas regard *dobsoni*, Trouessart, (i.e., *murinoides*, Dobs.) as merely an aberrant individual of *blythi*, and I therefore omit it. Similarly Thomas has indicated *caliginosus*, Tomes, and *siligorensis*, Tomes, as the representatives of *mystacinus*, Leisler. I have described a species, *peytoni*, from Kanara, and Thomas one from Darjiling, under the name of *sicarius*. These seven species may be arranged in a key as follows :—

Key to the species of MYOTIS.

A. Size large, forearm 40-57 mm.
  a. Colour pale, fawn or clay colour.
    a^1. Larger, forearm 57 mm. ... ... 1. *blythii*, Tomes.
    b^1. Smaller, forearm 42 mm. ... ... 2. *formosus*, Hodgs.
  b. Colour dark-brown.
    a^1. Under side pale ... ... 3. *sicarius*, Thos.
    b^1. Equally dark above and below ... 4. *peytoni*, Wr.
B. Size small, forearm 32-35 mm.
  a. Under side pale, silvery ... ... 5. *muricola*, Hodgs.
  b. Equally dark above and below.
    a^1. Forearm 32 mm. ... ... 6. *caliginosus*, Tomes.
    b^1. Forearm 35 mm. ... ... 7. *siligorensis*, Tomes.

DISTRIBUTION :—

1. *M. blythii*, Tomes.	*Type locality* :—Nasirabad, Rajputana (Boys). *Other localities* :—Simla (B. M.). *Type* :—B. M. No. 48.8.18.6. (Type of *murinoides*, Dobson, Ind. Mus. Calc. No. 176. a.)
2. *M. formosus*, Hodgson.	*Type locality* :—Nepal (Hodgson). *Other localities* :—Dharmsala, Punjab ; Mussoorie (B. M.). *Type* :—B. M. No. 43.1.12.141.
3. *M. sicarius*, Thomas.	*Type locality* :—Northern Sikkim (Mandelli). *Other localities* :—None. *Type* :—B. M. No. 91.1017.56.
4. *M. peytoni*, Wroughton.	*Type locality* :—Gersoppa Falls, Kanara (B. N. H. S.—Shortridge). *Other localities* :—Gersoppa Falls, Kanara (M. S. I.) *Type* :—B. M. No. 12.8.25.1.
5. *M. muricola*, Hodgson.	*Type locality* :—Nepal (Hodgson). *Other localities* :—Bhutan Duars ; Tenasserim (M. S. I.). *Type* :—B. M. No. 45.1.8.143.
6. *M. caliginosus*, Tomes.	*Type locality* :—"India". *Other localities* :—Simla, Punjab ; Sikkim (B. M.). *Type* :—B. M. No. 7.1.1.512. (Co-types of *blanfordi*, Dobson, B. M. Nos. 75.10.27.1. & 2. Type of Nipalensis, Dobs. Ind. Mus. Cal. 172. a.).
7. *M. siligorensis*, Tomes.	*Type locality* :—Darjiling. *Other localities* :—Sikkim (B. M.). Kumaon (M. S. I.) *Type* :—B. M. No. 79.11.21.125.

Gen. XVI.—LEUCONOE.

No. 203. *hasselti*, Temm.
No. 204. *longipes*, Blyth.
No. 205. *daubentoni*, Leisl.
No. 206. *megalopus*, Dobs.

Thomas has recently dealt with this Genus in this Journal (J. B. N. H. S., xxiii, p. 610, 1915). and he there points out that it is most doubtful whether *daubentoni* reaches our region at all. He also gives reasons for considering that *longipes* and *megalopus* are one species. Two species, *viz.*, *dryas* and *peshwa*, have been added since Blanford wrote. This makes a total of four species which may be arranged in a key as follows :--

Key to the species of LEUCONOE.

A. Size larger, forearm 40 mm.
  a. Colour paler ; hindfoot longer, 13 mm. ; middle premolar crushed inwards, less than one-third the size of first premolar... 1. *hasselti*, Temm.
  b. Colour darker ; hindfoot shorter 11 mm. ; middle premolar not or little crushed inwards, at least two-thirds the size of the first premolar ... ... 2. *peshwa*, Thos.
B. Size smaller, forearm 36 or 37 mm.
  a. Slightly larger, forearm 37 mm. ; underside almost as dark as upper ; general colour dark ; skull length 15 mm 3. *dryas*, K. And.
  b. Slightly smaller, forearm 36 mm. ; underside silvery ; general colour pale ; skull length 14 mm. ... ... 4. *longipes*, Dobson.

DISTRIBUTION :—

1. *L. hasselti*, Temminck.	*Type locality* :—Java. *Other localities* :—Northern, Central and Eastern Provinces, Ceylon (M.S.I.) *Type* :—Leyden Museum.
2. *L. peshwa*, Thomas.	*Type locality* :—Poona, Bombay (Wroughton). *Other localities* :—None. *Type* :—B. M. No. 0.9.16.1.
3. *L. dryas*, K. Andersen.	*Type locality* :—Andamans. *Other localities* :—None. *Co-type* :—B. M. No. 6.12.1.31. (Other co-type in Genoa Museum).
4. *L. longipes*, Dobson.	*Type locality* :—Caves of Bhima Devi, Kashmir. *Other localities* :—None. *Co-type* :—B. M. No. 76.3.10.4. (Type of *megalopus*, Dobson, B. M. No. 73.4.16.13.)

(*To be continued*)

NOTES ON A COLLECTION OF SEA SNAKES FROM MADRAS.

BY

LIEUT.-COL. F. WALL, C.M.G., C.M.Z.S., F.L.S., I.M.S.

During the months of June and July 1917, 192 sea snakes were collected for me in Madras through the instrumentality of Dr. J. R. Henderson, to whom my thanks are due. It was my intention to make a survey of the Coromandel Coast and to compare results with a similar synchronous survey on the Malabar Coast. The latter project however failed to crystallise. I selected the months of June and July because past observations had led me to expect the capture of many gravid females, and it will be seen that my expectations were justified.

As I had to pay a certain price per head, I stipulated that no *Enhydrina valakadyn* should be included, my previous experiences of marine collecting having shown me, that it might be quite possible to get two or three hundred specimens, and find them all of this species. Fifteen young specimens of this species however did come to bag not being recognised as such. The following remarks on this collection I think worth drawing attention to, in the light of my previous knowledge of sea snakes.

Although I knew that *Enhydris curtus* was a very common species I was not prepared to find it even more common than *Enhydrina valakadyn*. On the Malabar Coast (Cannanore) I found the latter very much more abundant.

After these two species it was my impression that *Hydrophis cyanocinctus* came a good third in numerical strength and *spiralis* (vel. *brugmansi*) a good fourth. It is remarkable that *cyanocinctus* proved so uncommon when it is much the most abundant species one meets with on the Sind and Persian Shores, and so common on the Malabar side. *Gracilis* proved to be very plentiful, far more so than it is on the Malabar side of India judging from my records.

It is further remarkable that no specimen of *caerulescens* came to bag though this is quite one of the commonest sea snakes about Bombay.

Once the monsoon had well set in the sea grew too rough for the fishermen to venture out, so that my captures for the whole of July were far fewer than for the last ten days of June. I give a synopsis of the collection for easy reference, and details of the more interesting specimens under their various headings.

SYNOPSIS OF SPECIES.

Date.	*Hyd. spiralis.*	*Hyd. gracilis.*	*Hyd. cantoris.*	*Hyd. fasciatus.*	*Hyd. ornatus.*	*Hyd. cyanocinctus.*	*Hyd. jerdoni.*	*Enh. curtus.*	*Enh. valakadyn.*	Remarks.
June.										
20	..	1	..	..	..	..	..	..	..	Sea very rough.
21	..	1	..	..	..	..	..	8	3	Fairly calm.
22	..	1	..	..	..	..	..	8	8	Do.
23	..	4	..	..	..	..	..	6	6	Do.
24	3	1	..	..	..	1	..	3	3	Rough.
25	1	5	..	1	..	..	1	13	8	Calm.
26	..	..	..	..	..	..	..	6	1	Rough.
27	2	4	1	..	..	..	..	16	7	Calm.
28	2	2	..	..	..	..	1	4	2	Fairly calm.
29	..	2	1	..	1	..	..	8	10	Do.
30	1	1	.	..	..	..	2	1	4	Rough and raining
July.										
1	..	..	1	..	..	..	.	4	3	Fairly calm.
2	1	3	..	..	..	..	..	1	2	Do.
3	..	3	..	1	..	..	1	..	3	Rough.
7	..	..	..	..	..	..	..	1	..	Do.
12	..	1	..	..	..	..	..	2	..	Do.
Total	10	29	3	2	1	1	5	81	60	=192

HYDROPHIS SPIRALIS (Shaw).

Date.	Sex.	Length in inches.	Costals.			Ventrals.	Remarks.
			2 heads lengths behind head.	Midbody.	2 heads lengths before vent.		
June							
24	♂	50	28	31	32	357	A murænid "in gastro."
,,	♂ ?	20¼	29	33	32	357	The intervals between the bands have vertebral and ventral spots posteriorly.
,,	♂	45¼	29	31	30	343	Var: *brugmansi* (Boie).
25	♂	33	26	31	31	347	38 black bands. A black vertebral spot in first 12 intervals, in the 13th and 17th, 27th to 30th, and 36th to last. A black ventral stripe interrupted to leave spots in last 6 intervals.
27	♀	48½	31	35	32	330	A murænid in the stomach 37 black bands. A black vertebral spot in last interval.
,,	?	30	28	31	31	?	A murænid "in gastro." Anterior temporal broken into 3 $\frac{1}{(1+1)}$ parts on left side. 45 black bands. Black vertebral spots in last 3 intervals. A pinkish suffusion on lips.
28	♀ ?	32½	29	33	34	358	Anterior temporal not descending to lip. 43 black bands. Vertebral spots in all the intervals from the 5th backwards. A connecting ventral stripe.
,,	♂	49½	28	31	28	323	Var: *brugmansi* (Boie).
30	♂	43½	26	31	30	329	Var: *brugmansi* (Boie).
July							
2	♀	36	31	34	36	349	41 black rings on body.

The murænid appeared to be of the same species as those mentioned under *gracilis*.

HYDROPHIS GRACILIS (Shaw).

Date.	Sex.	Length in inches.	Costals.			Ventrals.	Remarks.
			2 heads lengths after head.	Midbody.	2 heads lengths before vent.		
June							
20	♂	30½	17	28	31	229	
21	♂	28¼	19	28	32	231	
22	♂	28	19	32	33	259	
23	♂	29¼	18	29	27	228	
”	♀	25	19	31	29	256	
”	♀	24	19	33	32	279	
”	♂	30	17	29	31	236	
24	♀	29	19	31	34	272	Contained 2 sacs (2¾″ × ¾″) with embryos (♂ 11¼, ♀ 11½). The stomach contained 3 murænids.
”	♂	11¼	19	29	31	230	
”	♀	11½	19	30	30	261	
25	♂	36	19	29	29	254	
”	♀	25	19	30	30	258	
”	♂	28	19	31	29	249	
”	♀	24	18	28	32	251	
”	♂	27¾	19	29	31	263	
27	♀	22½	19	30	32	272	
”	♀	20½	19	29	30	222	
”	♀	28¾	..	..	..	..	Contained 1 sac with an embryo ♀ 10″. Two murænids found in stomach.
”	♀	10	19	30	31	215	
”	♀	28	19	31	32	255	Contained 2 embryos (♂ 9⅝,″ ♂ 10¾″).
”	♂	9⅝	18	28	28	224	
”	♂	10¾	18	?	31	237	
28	♀	27¼	19	29	31	261	Contained 2 embryos (♀ 12⅝″, ♀ 12¾″ ?).
”	♀	12⅝	19	29	28	227	
”	♀	12¾	18	29	29	240	
”	♀	27¾	19	29	32	247	Contained 2 embryos (♂ 11½″, ♀ 11¼″).
”	♂	11½	19	29	31	238	
”	♀	11¼	19	28	29	242	
29	♂	33	18	29	30	240	
”	♂	26	19	31	31	239	Two murænids in stomach.
30	♂	26	?	33	33	?	

			Costals.				
Date.	Sex.	Length in inches.	2 Heads lengths behind head.	Midbody.	2 Heads lengths before vent.	Ventrals.	Remarks.
July 2	♀	33	19	29	30	267	
,,	♂	30	19	30	31	241	One muraenid, 8 inches long, lying full length in gullet and stomach.
,,	♂	28½	19	29	31	255	
3	♀	25	17	30	30	243	
,,	♂	30	19	32	34	284	
,,	♀	36¾	19	31	33	256	Contained 3 sacs with embryos (♂ 12½, ♀ 12¾, ♀ 13¼).
,,	♂	12½	..	..	..	..	
,,		12¾	..	..	..	..	
,,	♀	13¼	..	..	..	..	
12	♀	36	19	30	32	257	Contained 2 sacs (4 inches long) with embryos (♀ 14¾ ?, ♀ 14½ ?).
,,	♀	14¾	..	..	..	..	
,,	♀	14½	..	..	..	..	

It will be observed from the above that the sexes are evenly balanced, there being 18 males to 25 females. There are no differences in the costal rows or in the ventrals to distinguish the sexes. Both sexes grow to a similar length.

As regards the breeding this is the least prolific of all the snakes I know competing with *Enhydris curtus* for this distinction.

Some of the elongate fish that I removed from the stomachs were submitted to Dr. J. R. Henderson for identification, and were pronounced muraenids with an element of doubt as to whether they were *Ophichthys boro* (Ham: Buch.) or *O. orientalis* (McClelland).

Dr. Henderson tells me the Tamils call this and other slender necked sea snakes "milagu kadiyan" literally "the pepper-grain-headed-biter" in allusion to its small head like a peppercorn (milagu).

HYDROPHIS CANTORIS (Gunther).

			Costals.				
Date.	Sex.	Length in inches.	2 heads lengths behind head.	Midbody.	2 heads lengths before vent.	Ventrals.	Remarks.
June 27	♂	52	23	36	40	409	Posterior sublinguals quite separated.
29	♂	29	23	33	40	408	ditto.
July 1	♂	55½	23	36	38	425	

All the specimens were quite typical except the posterior sublingual shields in two specimens.

HYDROPHIS FASCIATUS (Schneider).

			Costals.				
Date.	Sex.	Length in inches.	2 heads lengths behind head.	Midbody.	2 heads lengths before vent.	Ventrals.	Remarks.
June 20-30	♀	37½	29	46	47	445	Contained 4 sacs (2¼″) with embryos (13½″, 13½″, 14″, 14⅞″).
,,	?	13½	30	42	43	448	
,,	?	13½	29	42	44	462	
,,	?	14	31	43	41	430	
,,	?	14⅞	damag	ed.			
July 3	♀	36	31	49	45	483	Contained 4 sacs (2½″ to 2¾″) with embryos (14½″, 14¼ , 14¾″, 14½″).
,,	?	14½	28	49	46	473	
,,	?	14¼	29	45	44	474	
,,	?	14¾	29	47	47	449	
,,	?	14½	30	47	49	466	

Both specimens were quite typical. The embryos could not be sexed as none had the genitals extruded. I have noted recently with regard to a land snake (*Plectrurus perroteti*) that the male claspers become ensheathed before birth. In the species referred to the sex is revealed with certainty by the number of the subcaudal shields, and this enabled me to clear up a point that I had previously never been able to elucidate. If one is justified in assuming that the same habit holds good for all viviparous snakes, one may infer that the male embryos of *H. fasciatus* above referred to had retracted the claspers, and were very near their nativity.

In both adults the posterior sublingual shields were completely separated.

HYDROPHIS ORNATUS (Gray).

Date.	Sex.	Length in inches.	Costals.			Ventrals.	Remarks.
			2 heads lengths behind head.	Midbody.	2 heads lengths before vent.		
June 29	♀?	14¾	38	43	39	287?	

A typical young specimen, apparently this year's progeny. The temporals are 1 × 1. The supralabials 7, the 2nd not in contact with the praefrontal. The costals juxtaposed throughout.

There are 45 black crossbars on the body, 5 on the tail. On the body they are much broader than the intervals. A subcostal row of faint darkish sports alternate with the crossbars.

HYDROPHIS CYANOCINCTUS (Daudin).

Date.	Sex.	Length in inches.	Costals.			Ventrals.	Remarks.
			2 heads lengths behind head.	Midbody.	2 heads lengths before vent.		
June 24	♂	59	23	39	40	357	59 complete black bands on the body.

The claspers are not bifid.

HYDROPHIS JERDONI (Gray).

COSTALS.							REMARKS.
Date.	Sex.	Length in inches.	2 heads lengths behind head.	Midbody.	2 heads lengths before vent.	Ventrals.	
June 25	♀	33	17	19	19	226	Contained 2 (probably 3) sacs (2¾″ × ¾″) with embryos (♀ 11½″, ♂ 11¾″). A ♂ 11″ long with the claspers extruded was found in the same bundle which had apparently been liberated through cuts in the abdomen of the mother.
28	♂	21½	17	19	21	239	
30	♂	36	17	19	19	230	
,,	♂	27½	17	19	19	232	
July 3	♂	23	17	21	21	236	

ENHYDRIS CURTUS (Shaw).

COSTALS.			REMARKS.
Date.	Sex.	Length in inches.	
June 21	♀	28	Contained one large sac (3¾″ × 1¼″) with a single embryo (13¼″).
22	♀	29	Contained two sacs (3″ × 1′) with embryos (♂ 10″, ♀ 9½″).
,,	♀	28½	Contained two sacs (4¼″) with embryos (11¾″, 12¼″).
23	♀	30½	Contained two sacs containing embryos (11½″, 11½″).
25	♀	32½	Contained four saos with embryos(10⅞″, 11″,11″,11½″).
26	♀	27	Contained two sacs with embryos (♂ 11½″, ♀ 11½″).
,,	♀	29¾	Contained two sacs (4″) with embryos (12¾″, 13″).
27	♀	30	Contained two sacs (3″ × 1″) with embryos (♂ 8⅝″, ♀ 8½″).
,,	♀	30½	Contained one sac with an embryo (12¼″).
July 2	♀	30½	Contained two sacs with embryos (11¼″ and 12½″) and one unfertilised egg.
,,	♀	32	Contained one embryo (14″).
,,	♀	28½	Contained one embryo (13″).

Altogether 84 specimens were collected. Of 49 sexed, 21 proved to be ♂, and 28 ♀. The largest males were 31, 31½, and 31½ inches, and the largest females were 32, 32, 32, 32½ and 33½ inches.

The breeding season is evidently from May to August. Nine specimens evidently young of the year, ranged between 13 and 17½ inches. The young are at birth about 13 to 14 inches in length, 14 inches being the longest fœtal measurement. A specimen 17½ inches long on the 24th June was probably born in early May or even April. After the male embryos attain to about 11½ inches the genitals become ensheathed (see remarks on this subject under *H. fasciatus*), so that it is impossible to record the sex in many of the fœtuses. The claspers in a fœtus were observed to be not bifurcate. The brood is retained "in matri" for an unusually long period, for in viviparous land snakes I find at birth, the fœtus is about one-fourth the average length of a mature adult. In *curtus* it will be seen that they are nearly half the average maternal length at nativity. Seven specimens ranging between 19 and 21¾ inches seem to indicate that the growth during the first year of life is about 5 to 6 inches. This species and *Hydrophis gracilis* are the least prolific of all the snakes I know.

ENHYDRINA VALAKADYN (Boie).

Although I had arranged to exclude this species entirely from those being collected, fifteen were forwarded to me. Forty-five were rejected. Nearly all those I received were young of the year. Eleven specimens ranging between 12½, and 17 inches, were taken in June, and four others in the same month measured 27, 27½, 26, and 29½ inches, evidently the last year's production.

Dr. Henderson tells me the Tamil fisherfolk call this snake "pottai pambu" literally "female snake", the reason for which is obscure.

INDIAN DRAGONFLIES.

BY

Capt. F. C. Fraser, I.M.S.

(*With 5 Text-figures*)

(*Continued from page* 471 *of Volume XXV*)

Part II.

Order—Odonata, Fabricius.

Imago large sized, carnivorous; biting mouth-parts; reduced, bristle-like antennæ. Very large, facetted eyes; 3 accessory eyes (ocelli). Thorax bulky and composed of three parts—the prothorax, small, variable and separate which bears the fore-legs; the meso—and the meta—thorax fused together, complexly built, flattened above and in front, and below and behind, the former bearing the mid-legs and the fore-wings, the latter the hind-legs and the hind-wings. The legs made up of the usual parts, never used for walking, held forward when the insect is flying to assist the jaws in catching their prey. The wings four in number, all uniform in their essential characters, never folded when at rest, with long, straight or curved nervures and a system of secondary, finer nervures.

The costa and subcostal nervures joined at about the middle of the wings by a stout, transverse nervure (the "node"), 10 complete abdominal segments; the ventral plates narrow, folded under the overlapping borders of the abdomen. Genital orifice of the male (primary sexual organs) on ventral side of the 9th abdominal segment; secondary sexual organs of the male on the ventral side of the 2nd abdominal segment. The female sexual organs between the 8th and 9th abdominal segments. Respiratory organs, 4 thoracic spiracles and a pleural membrane and abdominal spiracles on the under surface of the abdomen.

Larva; similar to the imago in its essential characters; aquatic, carnivorous, without any resting stage (pupation). Labium with a prolonged chin ("mask") which is capable of snapping in and out. Antennæ similar to the imago. The facetted eyes as in the imago but smaller and in a less developed form. Ocelli generally more or less obsolete; wings gradually developing in successive instars, in the final stage showing almost the complete reticulation of the imago. Respiratory organs either caudal or rectal.

The Dragonflies split up naturally into two large suborders, the Anisoptera and the Zygoptera, which are differentiated by several important characters of which the principal is the difference in shape of the fore and hind-wings in the former and the uniform character of the wings in the latter. The Anisoptera are further sub-divided into 2 families and these again into 7 sub-families; the Zygoptera are sub-divided into 2 families and numerous genera without any intervening sub-families.

Suborder I.—ANISOPTERA.

Imago: the hind-wing differing from the fore by reason of its broad anal field. Between the 7th and 8th nervures, a complicated-shaped trigone and hypertrigone. Running from the trigone, between the 7th and 8th nervures, a distinctly limited discoidal field. Eyes variable. Labium variable. Male with a pair of superior anal appendages springing from the end of 10th segment and inferior anal appendages, often fused, deeply fissured or notched. Male genital organs extremely variable.

Wings held in a horizontal plane when at rest.

Larva: gills at the end of the dilated intestine, protected by a small, foliate opening. The anal opening encircled by three pointed spines; one unpaired dorsal spine from the 11th tergit and a ventral pair from the 11th sternit. The appendages of the male and female appearing in the adult larva between the ventral spines at the border of the 10th tergit, the inferior appendages of the male at the base of the dorsal spine.

KEY TO FAMILIES.

Labial palp (lateral lobe of labium) much larger than the middle lobe, which is very minute; the former forming a mask-like segment in contact, by a long, straight junction, with that of the opposite side across the middle line; the terminal segment obsolete.

The eyes always more or less contiguous.

The ocelli arranged in the form of a triangle around the vesicle, the middle one in front, lying at its foot, the hinder ones lying laterally.

The antenodal nervures in superior (1st series) and inferior (2nd series) costal spaces in continuation with each other, except the terminal one which in many Libellulines is only present in the superior costal space.

Trigone generally different in the two wings, lying in the transverse axis in the forewing and in the long axis in the hind-wing.

Trigone in the hind-wing generally in prolongation of the arc, in the forewing usually, widely distal to it...... *Libellulidæ.*

Labial palp (lateral lobe of labium), of nearly the same dimensions as the middle lobe, of two segments, the terminal of which is slim and pointed.

The antenodal nervures in the superior (1st series) and inferior (2nd series) costal spaces usually not in continuation with each other except occasional pairs, one or two of which are somewhat proximal to the middle point between the node and base of wing. These pairs meet at an angle which is bridged across by a triangular membrane stretched tautly between costa and subcosta.

Trigone in both pairs of wings uniform or but slightly differentiated.

In both wings, the trigone an equal distance from the arc.

In the male, the anal border or base of the hind-wing usually notched and possessing a prominent tornus .... *Aeschnidæ.*

KEY TO THE SUB-FAMILIES OF THE LIBELLULIDÆ.

No projection to the hinder border of the eyes or if present, then indistinctly circumscribed.

Anal border of the hind-wing in both sexes rounded or straight.

No tuft of hairs at the distal end of the anterior femoræ.

Ear-shaped processes on 2nd abdominal segment absent.

The male generally with poorly developed and differentiated anal appendages.

Very marked differentiation in the sexual organs of the 2nd abdominal segment.

Only occasionally species coloured metallic .... *Libellulinæ.*

A small, triangular or arched, circumscribed projection at the middle of the hind border of each eye

Anal border of the hind-wing notched in the male.

Nearly always a tuft of small hairs at the distal end of the anterior femoræ.

A small ear-shaped process at the sides of the 2nd abdominal segment in the males. (Very poorly marked in the *Hemicordulia*).

The male with robust, small appendages.

Considerable differentiation in the sexual organs on the 2nd abdominal segment.

Usually bright metallic coloured species .. .. *Cordulinæ.*

KEY TO SUB-FAMILIES OF THE AESCHNIDÆ.

Eyes broadly contiguous.

Vesicle prominent. (In the *Petalia* group the eyes only just touching and the vesicle very small).

The trigone in both pairs of wings nearly identical, very considerably elongated in the long axis of the wing.

Subcostal space free or traversed, cubital space with numerous nervures and only slightly differentiated.

A right-angled subtrigone in both wings.

Female with an ovipositor lying between a pair of valvular scales on ventral surface of the 9th abdominal segment.

Middle lobe of labium whole or with a flat, compressed, oval process terminating in a small swollen border. (Deeply notched in the *Petalia* group).

Larva: labium flat, the lateral lobe similar to the Gomphinæ; no mental bristles. Antennæ slim, 7-jointed, robust .. .. *Aeschninæ.*

Eyes separated by a broad space, the interval sharply edged posteriorly and considerably more narrow than the diameter of the eyes as seen from above.

The ocelli lying free or partially overhung by a prominent ridge whose shape, in the group approaches that of a vesicle.

In shape the trigone of fore and hind-wings is constantly slightly differentiated so that the trigone of the hind-wing appears somewhat elongated in the length of the wing; in the fore-wing, generally the costal and proximal sides of the trigone of uniform length.

Subcostal space always free of nervures and only a few in the cubital space.

Subtrigone in both fore-and hind-wings.

Female with a divided vulvar scale at the modified border of 8th ventral plate.

Middle lobe of labium whole.

Larva; middle lobe of labium flat, the lateral lobe shaped as a double hook; the lateral, flexible claw that terminates the basal part, extending beyond the middle line; no mental spines.

Antennæ 4-jointed; the third joint prolonged and flattened, the 4th small and clubbed.

Claw-hooks present .. .. *Gomphinæ.*

Eyes separated by a very small interval.

A vesicle present behind the ocelli.

The trigone in the fore-wing nearly right-angled, in the hind-wing elongated in the transverse axis of the wings; in the hind a very broad anal field with rows of straight reticulation.

Several nervures in the subcostal and cubital spaces.

No subtrigones.

Female with a split vulvar scale.

Middle lobe of labium with a small notch at the end.

Larva unknown .. .. *Chlorogomphinæ.*

Eyes just touching or else separated by a very small interval.

The two hinder ocelli situated at the lateral ends of a transverse protuberance whose form resembles slightly that of a vesicle.

Trigones in all four wings uniform, their costal side moderately longer than the proximal.

No nervures in the subcostal space but a few in the cubital space.

An imperfect subtrigone of uniform shape in both pairs of wings.

Female with a large, projecting but not fissured ovipositor.

Middle lobe of labium notched a little at the end.

Larva: the basal segment of the labium arched, the lateral lobes robust and complicated, their toothed borders overlapping or dovetailing across the mid-line. Chin and labial bristles. Antennæ 7-jointed, slim.. .. .. *Cordulegasterinæ.*

Eyes narrowly separated.

Vesicle poorly marked.

Head similar in shape to the Gomphinæ.

The trigone a little different in the two wings, in fore-wing its length lying in the transverse axis of the wing, in the hind in the long axis of the wing.

Subcostal space entire. A few nervures in the cubital space.

In the hind-wing an imperfect subtrigone as in Cordulegaster, in the fore-wing a highly differentiated subtrigone as in the majority of the Libellulines.

Female with an ovipositor like that of the Aeschninæ.

Middle lobe of labium notched at the end.

Larva with a flat mask, the lateral lobe of which is more like the Gomphines and Aeschnines than the Cordulegasterines and Libellulines.

Antennæ 7-jointed, short and moderately robust .. *Petalurinæ.*

Suborder II.—ZYGOPTERA.

Both pairs of wings identical in shape or at least nearly so. No formation of trigone or hypertrigone but in place of these, in the same area, an entire or traversed, right-angled or irregular rhomboid. Between the 7th and 8th nervures no differentiated discoidal field. Eyes clubbed, laterally prominent, separated, the space between them much broader than the breadth of one eye as seen from above. No vesicle present; the ocelli lying free in the middle of the forehead. The middle lobe and the two labial palps approximately the same size, the middle lobe deeply fissured. Male with pairs of superior anal appendages at the end of the 10th abdominal segment and pairs of inferior anal appendages at sides of anal orifice. The female with an ovipositor very similar to that of the *Aeschninæ*, only more developed.

[Wings of the imago held closed together over the dorsum when at rest.]

Larva: 3-tailed, foliate or stillette-shaped tracheal organs, the mid-dorsal out of the 11th tergit, the latero-ventral out of the 11th sternit.

KEY TO FAMILIES.

Node of wing remote from base.
Numerous antenodal nervures between costa and subcosta.
A general tendency to very close reticulation.
Often with partially metallic-coloured wings .. .. *Calopterygidæ.*

Node of wing close to base.
Only two antenodal nervures.
A tendency to the reduction of reticulation of wings.
Only minor secondary nervures.
Only very occasionally with coloured wings .. .. *Agrionidæ.*

Suborder I.—ANISOPTERA.

Family I.—LIBELLULIDÆ.

Subfamily I.—*Libellulinæ.*

The Libellulinæ are represented in India by species belonging to 34 different genera and form by far the largest subfamily of Dragonflies.

Although possessing a characteristic facies, considerable differentiation is found in shape, size and colour, and more especially in the morphology of the sexual organs of the males. They have a fairly general distribution, being found in the wet and dry zones, in the temperate, subtropical and tropical.

Generally they are insects of medium size with a robust thorax and a stout abdomen which latter part however is extremely variable and may be long and slender, short and depressed or compressed, cylindrical, parallel-sided, fusiform or a combination of any of these shapes.

They may be recognised by the following characters:—

1. Eyes always to a greater or lesser extent contiguous.
2. Occiput always triangular in shape.
3. The ocelli always arranged in a triangle around the vesicle.
4. The mid-lobe of the labium much smaller than the lateral, the terminal segment of the latter being missing.
5. The base of the hind-wing straight or rounded, never indented.

6. The 1st and 2nd series of the antenodal nervures corresponding. The outermost antenodal nervure often incomplete.
7. No ear-shaped process to the sides of the 2nd abdominal segment.
8. No marked projection on the hind border of the eyes.
9. No tuft of hairs at the distal end of the fore femoræ.

Ris, more for the sake of convenience in classification than for any natural philogenetic sequence, has divided the Libellulinæ up into 10 groups and a still later classification has split up the subfamily into 8 tribes, which latter arrangement it will be convenient to follow here.

Of the 34 Indian genera, 2 fall into Tribe 1; 8 into Tribe 2; 1 each into Tribes 3 and 4; 9 into Tribe 5; 3 into Tribe 7; and 10 into Tribe 8, whilst Tribe 6 has no Indian representatives.

KEY TO THE GENERA OF THE LIBELLULINÆ.

1. Arc between antenodal nervures 2-3, less often between 1-2.

Tribe 1.—Trigone nearly equilateral and poorly developed in the transverse diameter of the fore-wing.
Discoidal field commencing with but one row of cells.
Costal side of trigone in fore-wing bent.
7a absent or rudimentary.
Loop poorly developed or absent.
i. Arc between antenodal nervures 1-2.
Antenodal nervures numbering 7-9.
Trigone in hind-wing entire .. .. *Tetrathemis.*
ii. Arc between antenodal nervures 2-3.
Antenodal nervures numbering 14-16.
Trigone in hind-wing traversed.. .. *Hylæothemis.*

Tribe 2.—Trigone well-developed in the transverse diameter of the wing; its costal side in the fore-wing not bent (except in very occasional specimens of Amphithemis) and considerably shorter than the proximal or distal sides.
Discoidal field with at least 2 rows of cells.
Antenodal nervures never less than 10 (except in occasional specimens of *Lyriothemis*).
Sectors of arc fused for a short distance in the fore-wing (except in *Libellula*) and to a longer extent in the hind.
Loop generally well-developed, often reaching well beyond the external angle of trigone.
The lateral border of 8th abdominal segment of female more or less dilated (except in *Amphithemis* and variably in *Libellula*).
A. Lobe of prothorax small, not fringed with long hairs.
i. Not more than 2 rows of cells in discoidal field.
More than 1 cubital nervure in hind-wing.
Often supplementary nervures to bridge.

i¹ Eyes broadly contiguous.
Stigma large. (2·5-3 mm.) .. .. .. *Agrionoptera.*
ii¹ Eyes only slightly contiguous or just touching.
Stigma small. (2 mm.)
x. 8th nervure slightly separated from the posterior angle of trigone.
Trigone in fore-wing entire.
Sectors of arc in fore-wing long.
Abdomen slim and cylindrical.
Border of 8th abdominal segment in the female not dilated .. .. .. *Amphithemis.*
y. 8th nervure not separated from the posterior angle of triangle.
Trigone in fore-wing traversed.
Sectors of arc in fore-wing short.
Abdomen cylindrical and depressed.
Border of 8th abdominal segment in the female dilated .. .. *Lyriothemis.*
ii. More than 2 rows of cells in discoidal field.
Not more than 1 cubital nervure in the hind-wing.
a. Supplementary nervures to bridge .. .. *Cratilla.*
b. No supplementary nervures to bridge.
i¹. Eyes broadly contiguous.
Abdomen slim and narrow.
Discoidal field not dilated.
x. Arc between antenodal nervures 1-2.
2 rows of cells between 5-5a.
In the loop, bisected cells at trigone and external angle .. .. *Potamarcha.*
y. Arc between antenodal nervures 2-3.
1 row of cells between 5-5a.
In the loop, bisected cells at external angle only .. .. *Lathrecista.*
ii¹. Eyes just touching.
Abdomen broad and depressed.
Discoidal field much dilated .. .. *Libellula.*
B. Lobe of prothorax large and fringed with long hairs .. .. *Orthetrum.*

II. Arc always between antenodal nervures 1-2, (except in some species of *Neurothemis*).

Tribe 3.—Wings parti-coloured with black and golden yellow.
Sectors of arc of fore-wing shortly fused, occasionally separated.
Hypertrigone in fore-wing usually traversed many times.
Cubital nervures in fore-wing often numerous.

Occasional supplementary nervures to bridge.
Loop large; its mid-rib nearly straight.
The part of costa, lying between node and base of wing, markedly indented.
Lobe of prothorax large .. .. .. *Palpopleura.*

Tribe 4.—Wings uncoloured.

Sectors of arc in fore-wing fused shortly, in hind-wing through a longer extent.

4, 5, 5a slightly convex, running parallel to one another.

Final antenodal nervure complete.

5a often broken.

7a variable, absent or rudimentary.

Supernumerary cubital nervures often present.

Trigone of hind-wing a little distal to arc .. *Brachydiplax.*

Tribe 5.—Wings uncoloured or coloured.

Sectors of arc as for Tribe 4.

4, 5 and 5a variable.

Final antenodal nervure nearly always incomplete (except Pachydiplax and individual specimens of Acisoma).

5a strongly concave to the 5th nervure.

7a usually well-formed.

Only 1 cubital nervure to all wings.

Eyes just meeting or only shortly contiguous (except Bradinopyga.)

Trigone of hind-wing at the arc or a little proximal.

Tentaculæ of male usually bipartite.

Vulvar scale usually prominent.

i. Lobe of prothorax large, often bilobed and bearing a fringe of long hairs.

- a^1. Antenodal nervures numbering less than $10\frac{1}{2}$.
  - i^1. Abdominal segments 1-5 greatly dilated, the remainder much attenuated.. *Acisoma.*
  - ii^1. Abdominal segments 1-5 not dilated, at least 4 and 5 not dilated.
    - a^2. Eyes moderately contiguous. Discoidal field contracted at termen .. *Sympetrum.*
    - b^2. Eyes only just touching. Discoidal field dilated at termen .. *Diplacodes.*
- b^1. Antenodal nervures numbering not less than $10\frac{1}{2}$. The discoidal field commencing with 3 rows of cells, then 2 rows as far as line of bridge .. .. *Rhodothemis.*

ii. Lobe of prothorax small.

- a. Discoidal space much dilated.
  - a^1. A great development of secondary reticulation in the wings. Wings for the greater part coloured golden yellow or dark brown .. .. *Neurothemis.*
  - b^1. No secondary reticulation in the wings. Wings either not coloured or not so extensively.
    - i^1. Eyes broadly contiguous. 2 or more rows of cells between 5-5a .. *Bradinopyga.*
    - ii^1 Eyes moderately contiguous or only just touching.

1 or only occasionally 2 rows of cells between 5-5a.
x. Abdomen depressed and broad, bright red in colour.
Discoidal field usually with 3 rows of cells .. .. *Crocothemis.*
y. Abdomen depressed but sides parallel, dark brown, yellow or black.
Discoidal field commencing with 3 rows of cells and then for a short distance 2 rows .. .. *Indothemis.*
b. Discoidal field very slightly dilated, or of even width throughout.
Antenodal nervures $6\frac{1}{2}$-$7\frac{1}{2}$ .. .. .. *Brachythemis.*

Tribe 6.—No Indian genera.

Tribe 7.—Node of fore-wing considerably distal to the middle of the wing.
Antenodal nervures usually very numerous.
Sectors of arc as for Tribes 4 and 5.
Mid rib of loop bent at an obtuse angle but little larger than a right angle.
Trigone in hindwing nearly always a little proximal to arc.
Discoidal field of even width throughout or contracted at the termen.
Tentaculæ divided but the outer division small.
Vulvar scale very small.
a. Large, black and metallic-green species, with bright yellow markings.
Discoidal field of even width throughout.
Wings unmarked.
i. Supernumerary cubital nervures present in fore-wing.
Trigone in hind-wing traversed.
1 row of cells between 5-5a.
Claw-hooks unusually robust.
Lobe of prothorax small .. .. .. *Zygonyx.*
ii. No supernumerary cubital nervures.
Trigone in hind-wing entire.
2 rows of cells between 5-5a.
Claw-hooks entirely absent.
Lobe of prothorax large .. .. .. *Onychothemis.*
b. Moderately large, non-metallic species, generally red, yellow or frosted with blue.
Discoidal field much contracted.
Wings usually bearing a basal spot.
No supernumerary cubital nervures.
Lobe of prothorax small.. .. .. .. *Trithemis.*

Tribe 8.—Sectors of arc either separate or only fused for a short distance in the forewing. (A longer fusion often present in *Pantala.*)
Basal area of hind-wing very broad with the cells often arranged in transverse rows.

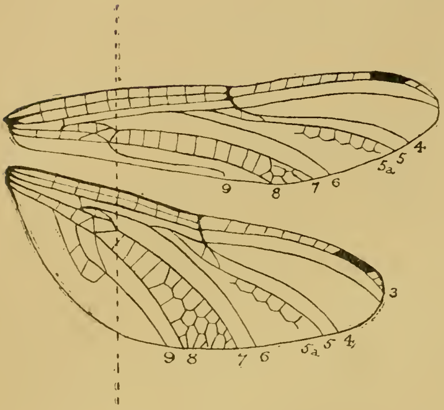
Often a sector leaving the posterior border of loop which splits up the basal area into an inner field of small, closely arranged cells and an outer of larger, irregularly arranged cells.
Lobe of prothorax small.
Final antenodal nervure incomplete (except *Aethriamanta* and *Macrodiplax*).
Wings usually long and broad.

a. Costal side of trigone in fore-wing short, shorter than half the proximal.
i. Stigma in fore-wing much longer than that of hind-wing.
a¹. Transverse ridges to 2nd, 3rd 4th and 5th abdominal segments.
Basal marking of hind-wing a clear, hyaline amber tint .. .. *Pantala.*
b¹. Transverse ridges to 2nd, 3rd, and 4th abdominal segments only, none to the 5th.
Basal marking of hind-wing a dark, opaque brown. (In *T. basilaris* this mark lies in a clear amber setting) .. .. .. *Tramea.*
ii. Stigma in fore-wing only a little larger than in hind-wing .. .. *Hydrobasileus.*
iii. Stigma in fore and hind-wings the same size.
Loop open at the apex... .. .. .. *Tholymis.*

b. Costal side of trigone in the fore-wing long, longer than half the proximal.
i. Antenodal nervures in fore-wing more than 7.
i¹. Trigone in hind-wing entire.
Cubital nervures in hind-wing not more than 1.
No supplementary nervures to bridge.
No secondary reticulation in basal area of hind-wing.
a¹. Eyes as broadly contiguous as the antero-posterior diameter of occipital triangle.
Sectors of arc separated in the fore-wing, shortly fused in hind-wing.
Wings marked with black and yellow, fuliginous, often with a metallic gloss. *Rhyothemis.*
b¹. Eyes as broadly contiguous as twice the antero-posterior diameter of occipital triangle.
Sectors of arc not separated in the fore-wing, long fusion in hind-wing.
Apex of loop not closed.
Wings not marked with black and yellow and with no metallic gloss .. .. *Zyxomma.*
ii¹. Trigone in hind-wing traversed several times.
Cubital nervures in hind-wings more than I.
Nearly always supplementary nervures to the bridge.
A secondary reticulation of small, closely-set cells in basal area of hind-wing .. *Camacinia.*
ii. Antenodal nervures in fore-wing not more than 7.

i¹. Wings short and broad.
Subtrigone formed of only 1 cell .. .. *Aethriamanta.*
ii¹. Wings long and broad.
Subtrigone formed of 3 cells.
x. Small forms, abdomen moderately long and tapering, dull coloured .. .. *Macrodiplax.*
y. Larger forms, abdomen broad and depressed, bright, scarlet red .. .. *Urothemis.*

Genus TETRATHEMIS.



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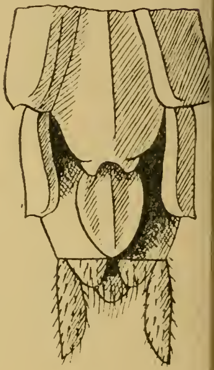

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Fig 1.—Wings of *Tetrathemis platyptera* (×3¼) showing main neuration.
,, 2.—Female sexual organs of same (×16).

Tetrathemis, Brauer, 1868. Kirby, Trans. Zoo., Soc. Lond., 12, pp. 259, 309, tab. 56, fig. 8 (1889).

Neophlebia, Selys. Kirby, Trans. Zoo. Soc., Lond., 12, pp. 259, 309, tab. 56, fig 8 (1889).

Type, *T. platyptera*, Atkinson.

Head moderately large ; eyes broadly contiguous ; front broadly rounded and without a marked foreborder. Suture flush ; vesicle high, notched above and with a small tubercle on each side of the indentation.

Prothorax lobe large, outwardly rounded, its free border slightly notched in the middle and furnished with a ruff of long hairs.

Thorax moderately narrow.

Legs robust and long. Male ; hind femoræ in their second fourth with a row of regularly sized, small, quadrilateral spines with apices sloping somewhat basalwards ; ordinary spines at the end. Mid femoræ with the usual, somewhat triangular, gradually lengthening spines with a final, single, long spine at the distal end. Female with no specially differentiated armature from that of the male. Mid femoræ with fewer, widely separated, gradually lengthening spines ; tibial spines moderate, slim and fragile ; claw-hooks ordinary.

Abdomen short, slim and slightly fusiform in the male, cylindrical in the female.

Genitals ; male; small tentaculæ with no distinct outer branch ; superior appendages slim and strongly curved. Female ; border of 8th segment not dilated ; 8th ventral plate prolonged in a somewhat projecting vulvar scale; ventral plate of 9th segment drawn out into a long, tongue-like process which overlaps a small 10th segment, the latter furnished with long, fine bristles.

Wings small to moderately broad, nearly always partly coloured ; reticulation moderately open ; trigone in the fore-wing with a nearly, uniformly broken or bent costal side ; trigone in fore-wing in line with the trigone of the hind ; arc between antenodal nervures 1-2 ; sectors of arc stalked for a long distance ; 8th and 9th nervures joined at the posterior angle of the trigone in the hind-wing or occasionally separated for but a short distance ; 7-9 antenodal nervures, the final one complete ; trigone in the hindwing distal to the arc ; 4th nervure with but a single, flat curve ; 1 row of cells between 5 and 5a ; 5a only poorly developed ; cubital nervures in fore-wing varying, the distal one corresponding to the costal side of subtrigone which is not regularly formed ; 2 to 5 cubital nervures in the hind-wing ; all trigones entire ; hypertrigones usually traversed ; 1 row of cells in discoidal field of fore-wing ; 8th nervure in fore-wing nearly straight, the discoidal field nearly parallel and a single row of cells nearly up to the termen where the field is a little dilated ; no supplementary nervures to bridge ; variable loop, small, closed, seldom of more than 4 cells.

Stigma medium. Membrane nearly obsolete.

Key to Species.

i. Base of wings a deep yellow colour, in the fore up to trigone, in the hind up to node.
Brown colouration of apices if present, only poorly so and diffuse.
2-3 cubital nervures in the hindwing .. .. *T. platyptera.*

ii. Base of wings hyaline.
Brown colouration of apices well-marked and sharply limited.
2 cubital nervures in the hind-wing .. .. *T. yerburyii.*

1. **Tetrathemis platyptera,** Selys.

T. flava, Kruger.

T. pulchra, Laidlaw. Proc. Zoo. Soc., Lond., 1902, *I, p.* 71, *tab.* 5, *fig.* 3.

Expanse 45 mm. Length 24 mm.

Head, thorax and abdomen a dark yellow colour.

Wings ; hind-wing rather short, the base bearing a constant bright yellow suffusion extending from the base to the node or a little beyond it ; in the fore-wing this suffusion reaches only to the trigone and has a somewhat diffuse outer border. Beyond the node, the wing hyaline with, in some specimens, a brown marking of the posterior part of the apex.

Antenodal nervures in the fore-wing 9, in the hind 7 ; cubital nervures in the fore-wing 1-2, in the hind 3. Superior appendages short, cylindrical, pointed and in the female somewhat remote.

Genitals ; female ; vulvar scale reaching up to the 9th abdominal segment, not projecting, terminating in a small, sharply curved arch. 9th ventral plate prolonged in a small, elliptical tongue, placed somewhat below and behind, overlapping the 10th segment which latter is furnished with setæ. Stigma 2 mm.

Hab. Bengal, Malacca.

2. Tetrathemis yerburyii, Kirby, *Linn. Soc. Jour., Zoo.* 24, *p.* 536, *tab.* 41, *fig.* 4, 1893.

Expanse 46 mm. Length 30 mm.

Male; head; labrum and labium yellow, marked with black; face yellow; forehead black metallic green with yellow markings below its external border and a yellow spot near the eye; occiput and occipital cavity black. Prothorax large, notched in the middle, black with a broad, yellow border. Thorax deep black with three yellow bands, the first over the lower two-thirds of the humeral region, the second traversing the anterior thoracic spiracle and the third over the hinder half of the metathorax.

Abdomen cylindrical, fairly robust, a little dilated at the base, black with yellow markings as follows:—A basal lateral stripe running from the 2nd to 5th segment, gradually tapering away on the sides of the latter, an interrupted mark on the middorsum and a half ring extending about one-third the length of the segments from their bases.

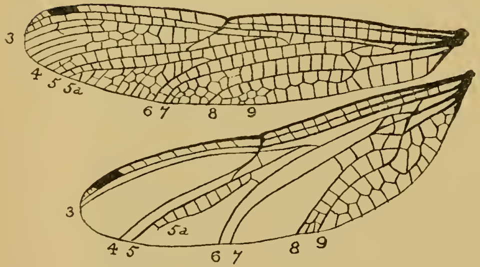
Superior appendages small, the pointed apex turning outwards, the distal half of the underside dentate or spined. Inferior anal appendages of uniform length. Genitals; 2nd abdominal segment very small, the tentaculæ scarcely visible from the side, fairly slender, backwardly and inwardly directed hooks. Lobe usually narrow and indistinctly separated from the segmental border.

Wings hyaline, the base very light yellow and the apex with a rounded, brown spot reaching as far as the stigma. 9-10 antenodal nervures in fore-wing, 8 in the hind; 1 cubital nervure in the fore-wing, 2 in the hind. Stigma 2 mm.

Female; colour same as in the male except that the spots on the abdomen are somewhat larger. 8th ventral plate overlapping the 9th segment up to about its middle, its free border forming a low arch, the 9th ventral plate prolonged into a long, narrow, tongue-like process nearly pointed at the apex and ciliated.

Hab. Bengal, Assam, Tenasserim.

Genus HYLÆOTHEMIS.



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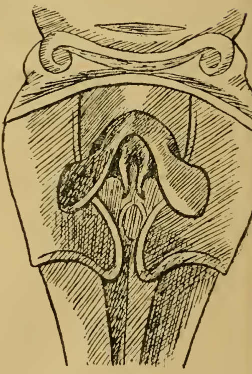

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Fig 3.—Wings of *Hylaeothemis* (× 2½) showing main neuration.

,, 4.—Male secondary organs of same (× 19) viewed from below.

Hylæothemis, Ris.

Tetrathemis, Karsch. Ent. Nachr., 15, p. 321 (1889).

Head moderately rounded; eyes very shortly contiguous; front rounded without any prominent foreborder; suture moderately deep; vesicle large, with a scarcely perceptible notch, the ocelli projecting from its lateral ends.

Prothorax lobe large, projecting, rounded and notched centrally.

Thorax narrow. Legs moderately large, robust. Male; hind femoræ with an external row of numerous, very small, triangular, apicalwards directed spines; a longer spine at the distal end; mid femur with similar spines on its basal half, followed by three larger and more widely separated spines. Tibial spines long and slim; claw-hooks robust, the points not sloping.

Abdomen slim, cylindrical; male; segments 7-9 a little broadened; female much stouter than the male, laterally compressed, segments 7-10 dilated, especially the 8th and 9th whose sides are foliately expanded. Genitals of male; 2nd abdominal segment large and prominent, tentaculæ foliate. Genitals female; border of 8th segment raised into a foliate projection, its free border arched and deeply notched; 9th ventral plate keeled. Anal appendages of male as long as 9th segment, cylindrical, pointed, curving strongly ventralwards. The inferior fused, narrow, triangular and curving upward to meet the superior. Superior appendages of the female much smaller than those of the male, more remote, cylindrical, about as long as the 10th abdominal segment.

Wings long and narrow, the hind a little broader than the fore, apices rounded. The node widely distal to the middle of the wing; trigone in fore-wing in line with that of hind; arc between the 1st and 2nd antenodal nervures; sectors of arc fused to a long extent; 8th nervure in the fore-wing out of the posterior angle of the trigone, in the hind widely separated; 14-16 antenodal nervures; trigone in hind-wing widely distal to the arc, its costal side whole or near its distal end obtusely bent; 4th nervure flat in its proximal part but rather sharply bent near the termen; only 1 row of cells between 5-5a; trigone in the fore-wing very small, the costal side very obtusely bent at its distal third; subtrigone and trigone in fore-wing entire; trigone in hind-wing large, traversed; all hypertrigones traversed; 2 cubital nervures in fore and hind-wings; only 1 row of cells in discoidal field of fore-wing nearly up to termen; 8th nervure nearly straight; discoidal field nearly parallel or a little dilated at the end; loop very indistinct, of only four cells and sharply limited. Stigma medium-sized. Membrane very small. In the female the wings are apt to show considerable differences. The costal side of the trigone in fore-wing is not usually bent and the same side in hind-wing may or may not be bent. The loop is much more developed, there being 6 to 7 cells in its composition. The node is nearer the middle of the wings.

3. **Hylæothemis fruhstorferi,** Kirby, *Cat. of Neuroptera-Odonata, pp.* 44 1890.

Tetrathemis fruhstorferi, Karsch.

Male, Expanse 60 mm. Length 38 mm.

Female, Epxanse 65 mm. Length 38 mm.

Male, head: labium bright yellow, the inner border and the middle lobe black; epistome and lower part of face bright yellow; vesicle and forehead a brilliant metallic green or bluish-green; occiput black with a spot of bright yellow posteriorly; eyes bottle green above, yellowish green beneath.

Prothorax: lobe of large size, pale blue, notched in the middle and furnished with a ruff of long hairs. Front part of prothorax with a pale blue collar, the remainder black with an angular blue spot in middorsum.

Thorax deep black with pale blue markings as follows :—A middorsal, fine geminate line with a T-shaped mark above it ; an irregular, sinuous, humeral line and two broad, lateral fasciæ. Overlaid or frosted with blue beneath, the frosting sometimes extending to the sides.

Occasionally the lateral, blue markings are greenish yellow and after death, the blue always tends to fade to a yellow tint.

Legs black with a bluish bloom on the under surfaces; hind femoræ with very small, numerous spines and a longer one at the extreme distal end.

Abdomen slim, base very little dilated, 3rd to 6th segments triquetral on cross section and very slender; 7th to 9th a little dilated and together forming a fusiform end to the abdomen; black with blue markings as follows:—a triangular blue spot on middorsum of 1st segment, and a linear blue mark on the dorsum of 2nd, lateral blue spots on the sides of both of these two segments and also on the sides of the 3rd to the 6th, the spots on the latter somewhat quadrilateral and followed posteriorly by a small streak of the same colour, lastly 2 very large, conspicuous blue spots on the dorsum of 7th segment. The 8th to 10th segments with no markings.

Anal appendages black.

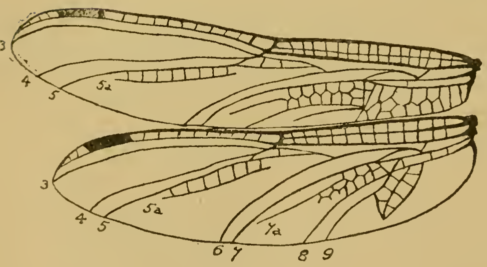
Female much larger and more stoutly built than the male. The markings similar to the male but much more extensive and although blue-marked specimens are not uncommon, as a rule, the markings in the female are a bright greenish yellow. Beneath the abdomen, running parallel with the borders of the pleural membrane, is an additional blue or yellowish stripe.

Wings of both sexes with an amber coloured spur in the inferior costal space, reaching as far as 1st antenodal nervure and another in the cubital space reaching as far as the 1st cubital nervure.

Stigma nearly black. 2·5 mm. Membrane nearly obsolete, grey. Wings hyaline.

Hab. Beds of rocky mountain streams, where they keep to the edge of the jungle. Foot hills of the Western Ghats, Nilgiris.

Genus AGRIONOPTERA.



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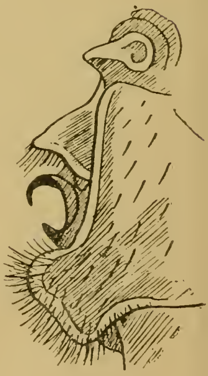

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Fig. 5.—Wings of *Agrionoptera insignis* (×2½) showing main neuration.
„ 6.—Male secondary sexual organs (×16) viewed from the side.

Agrionoptera, Brauer.
Libellula, Rambur.

Head medium sized ; eyes broadly contiguous ; front in the male prominent with a distinct foreborder and sharply pointed angles, in the female, rounded and less prominent, the angles and foreborder only indistinctly seen. Vesicle deeply notched.

Lobe of prothorax very small, flatly convex, not projecting.

Thorax robust. Legs long ; male ; hind femoræ with numerous small spines with a few longer ones at the distal end ; tibial spines, fine, short and numerous ; legs of the female short ; the hind femoræ only differing by the spines being less numerous.

Wings : reticulation very close ; antenodal nervures 15-16 ; 1 cubital nervure in the fore-wing, 1-3 in the hind ; 4th nervure with a slight costal convexity ; 1 row of cells between 5-5a ; trigone in fore-wing traversed, in the hind entire ; supplementary nervures to bridge variable : discoidal field beginning with 3 rows of cells, then five sets of two : 7a distinct in the hind-wing, variable in the fore ; loop well formed, without bisected cells. Stigma moderately large, 2·5-3 mm.

Abdomen slim, somewhat fusiform in the male, cylindrical in the female.

Genitals, male : secondary sexual organs small, procumbent, coated with many yellowish bristles ; tentaculæ small, semi-arched, narrow, with small hooks. Lobe broadly rounded and somewhat dilated at the end. Female ; lateral borders of 8th abdominal segment broadly and foliately dilated ; at the end of the 8th ventral plate a very small vulvar scale in the form of two rounded, glossy, leaf-like organs which approximate to each other ; 9th ventral plate raised into a stunted, yellowish carination bearing a long bristle at its end and barely projecting beyond the 10th abdominal segment.

4. **Agrionoptera insignis**, Ris.
Agrionoptera quatornata, Brauer.
A. insignis, Brauer. *Libellula insignis*, Rambur.
Agrionoptera nicobarica, Brauer.
Agrionoptera similis, Selys.
Agrionoptera papuensis, Selys.
Agrionoptera insularis, Kirby.
Agrionoptera variabilis, Kruger.

Expanse, male 54 mm. Length, male 36 mm.
female 58 mm. female 36 mm.

Small species.

Thorax : dorsum a dark bronze green with two fine yellow stripes in the middle line ; a humeral, linear spot below and a more prominent band above it ; the sides bright yellow with bronze green markings or the ground colour a bright brown tint with three dark bands traversing it, the first, undivided, passes directly behind the humeral region, the second, often forked, crosses over the lateral thoracic spiracle, the third also forked, somewhat ventral to the middle of the thorax, the hind branch of the fork passing to the anal border of posterior part of thorax. All these markings are extremely variable and often broken up and anastomosing with each other so that most specimens show an irregular collection of spots. In the female, the markings are similar but darker and more defined.

Abdomen, male : segments 3-7 scarlet red, the lateral borders and the distal end of segment 5 narrowly black, segments 8-10 and the anal appendages black. Female brown instead of red, otherwise similar.

Genitals of female : dilatation of 8th segment uniformly present ; 9th ventral plate specific in character, the basal part somewhat grooved, the apical part laterally compressed and projecting more ventralwards than usual in the subfamily.

Wings hyaline with occasional dark yellowish brown rays in subcostal space nearly up to the 1st antenodal nervure and in the cubital space as far as the cubital nervure. Stigma 2·5 to 3 mm.

Hab. Assam, Bengal, Burma, Malaysia.

Genus AMPHITHEMIS.

Amphithemis, Selys. 1891.

Head moderately large, globular; eyes shortly contiguous; forehead somewhat prominent, flattened above, with a very prominent foreborder; suture flush; vesicle notched.

Prothorax lobe small, a little arched above, not projecting.

Thorax moderately narrow.

Legs moderately long, spined but without any particular specific character; claw-hooks moderate, situated about the middle of claws.

Abdomen long or moderately long, dilated at the base, then cylindrical or fusiform.

Genital organs, male: 2nd abdominal segment large; tentaculæ furnished with foliate hooks; female; border of 8th abdominal segment not dilated; vulvar scale very small, deeply notched at the apex.

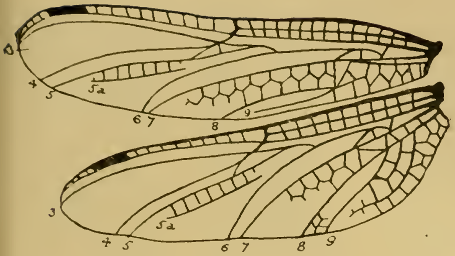
Wings rather narrow, the hind not much broader than the fore; trigone of fore-wing in line with that of hind; sectors of arc fused for a moderate distance; arc between 2nd and 3rd antenodal nervures; 8th nervure in the hind-wing removed a short distance from the posterior angle of the trigone; antenodal nervures 11-13, the final incomplete; the base of trigone in hind-wing usually moderately broad and variably distal to arc; 1 cubital nervure in the fore-wing, 3 in the hind; 1 and occasionally 2 supplementary nervures to the bridge; trigone in fore-wing broad, its costal side near the distal end, often broken or bent in a somewhat obtuse angle; trigone in fore-wing free, in the hind, free or traversed; subtrigone in the fore-wing entire or traversed by one or two nervures; all hypertrigones traversed (seldom entire in the hind-wing); 4th nervure nearly straight but bent slightly basalwards near the termen; 1 row of cells between 5 and 5a; discoidal field in the fore-wing beginning with 2 rows of cells, occasionally only 1, near the termen strongly dilated; 8th nervure short and sharply curved; anal field in fore-wing with 2 rows of cells, in the hind moderately broad with a normal-shaped loop formed of some 6 cells and with an obtuse outer angle.

Stigma small; membrane very small.

KEY TO SPECIES.

A. Discoidal field beginning with 2 rows of cells. (Very rarely with one.)
  i. Abdomen long and slim, yellow or black. Superior anal appendages slim, twice or more than twice as long as the inferior .... *A. vacillans.*
  ii. Abdomen short and cylindrical, red. Superior anal appendages robust but not half as long as the inferior........ *A. curvistyla.*
B. Discoidal field beginning with only 1 row of cells.
  Thorax with antero-dorsal, bright-yellow bands .... *A. mariæ*

5. **Amphithemis vacillans,** Selys. *Ann. Mus., Civ. Genova*, 30, *p.* 457 (1891).



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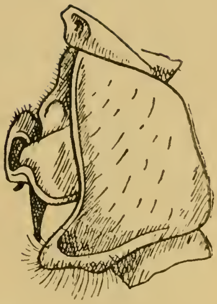

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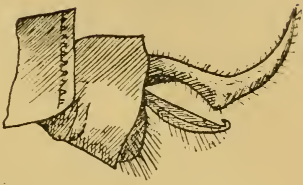

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Fig. 7.—Wings of *Amphithemis vacillans* (×3) showing main neuration.
" 8.—Male secondary sexual organs of same viewed from the side (×16).
" 9.—Anal appendages of male of same (×16).

Expanse 54 mm. Length 36 mm.

Male differs according to its age. Male, subjuvenile and juvenile specimens and females :—Labrum, labium, epistome and clypeus white; front and vesicle metallic green.

Thorax yellowish, somewhat darker or brownish on anterior dorsum.

Abdomen long and very slim, segments 1 to 3 yellow, 4th segment similar but the borders and distal end narrowly black, 5th to 7th segments black with narrow yellow dorsal spots, 8th to 10th entirely black.

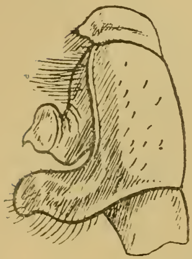
Adult males entirely black without any yellow markings.

Wings : trigone in fore-wing entire ; subtrigone usually traversed once and very seldom entire, occasionally in the female 3-celled ; trigone in the hind-wing usually free but sometimes traversed once or twice or the trigone of one side may be traversed and that of the other entire. Usually 1 cubital nervure in fore-wing and 3 in the hind. Stigma 2 mm. Superior anal appendages of male slim, bases approximating, the ends long and tapering and curving strongly dorsalwards.

Genital organs of the female: lateral borders of the 8th segment not dilated; vulvar scale very small and very sharply rounded.

Hab. Burma, Bhamo and Karen Hills.

6. Amphithemis curvistyla, Selys, *Ann. Mus., Civ. Genova,* 30, *p.* 455 (1891).



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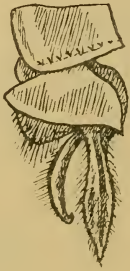

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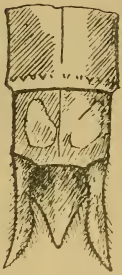

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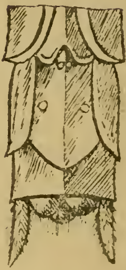

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Fig. 10.—Male secondary sexual organs of *Amphithemis curvistyla* (×12) seen from the side.
,, 11.—Anal appendages of same (×16).
,, 12.—Anal appendages of male seen from above (×16).
,, 13.—Sexual organs and anal appendages of female of same seen from below (×16).

Expanse 44 mm. Length 30 mm.

Male and female: labrum, labium epistome and clypeus white, forehead and vesicle metallic green.

Thorax on its dorsal anterior surface and the humeral region blackish-brown or in juvenile forms yellow with a black, humeral stripe, laterally bright yellow with a median, oblique, black band; ventral surface black. Abdomen moderately short, nearly cylindrical, 1st segment red with its proximal end edged with black, 2nd and 3rd segments red, 4th to the 8th black with a red dorsal spot, 9th and 10th and the whole of the ventral surface black.

Wings: trigone in the fore-wing usually entire; subtrigone in fore-wing entire or one or either side may be traversed in the female; trigone in the hind-wing usually traversed; usually 1 cubital nervure in the fore-wing, 3 in the hind or the number differing in the four wings of the same specimen: no supplementary nervures to the bridge (occasionally one present); all hypetrigones traversed. Stigma 2 mm.

Superior anal appendages of the male robust, the lower edge projecting a little, the ends approximating, not curving dorsalwards but diverging laterally.

Genital organs of the female; lateral borders of the 8th abdominal segment slightly dilated; vulvar scale very small, in the form of a semi-arch, fissured.

Hab. Burma.

7. **Amphithemis mariæ**, Laidlaw, *Records, Indian Museum*, Vol. XI, 1915, p 337-339.

Types, Indian Museum.

Expanse 44 mm. Length 29 mm.

Male : Head, cream-coloured, bordered with black ; labrum and face creamy yellow ; forehead, vesicle and occiput metallic-green.

Prothorax black.

Thorax : dorsum black with a broad, greenish-yellow, humeral stripe on either side ; tergum brick red. Laterally brownish yellow with two well-defined, dark bands ; ventral surface yellow.

Wings hyaline, the bases with a yellow suffusion reaching as far as the trigones. Relatively shorter and broader than in *vacillans* and *curvistrla*. Trigones and hypetrigones not usually traversed ; 3 cubital nervures in the hind-wing ; 5a poorly developed discoidal field beginning with but a single row of cells.

Legs black, the anterior femoræ with a yellow stripe on their ventral surface.

Abdomen : segments 1-3 brick red, the last with a narrow, distal annulus, remaining segments black, 4-7 with a proximal yellow annulus, broadest laterally and diminishing in size as traced towards the anal segments.

Anal appendages black, scarcely differing from those of *curvistyla*.

Genital organs : lamina very small ; tentaculæ, internal segment with a fine, backwardly-directed spur. Lobe small, triangular, arching a little forward.

Female : Head as for male.

Prothorax pale yellow.

Thorax brownish black on the dorsum, with a pair of very wide, pale yellow, ante-humeral bands which meet together above. Laterally pale yellow.

Abdomen : segments 1-3 pale yellow, 3 with a fine, black, proximal annulus, 4-8 yellow proximally, the distal half yellow, the yellow annulus being rather broader on the 8th segment. A fine, mid-dorsal, black line. Segments 9-10 entirely black.

Anal appendages black.

Genitals : border of 8th abdominal segment not dilated. Vulvar scale very small.

Hab. Southern India, Cochin State, 1,600.

(*To be continued.*)

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A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams

BY

F. Wall, C.M.G., C.M.Z.S., F.L.S., Lieut.-Colonel, I.M.S.

Part XXV (with Plate XXV and Diagram).

(Continued from page 382 of Volume XXV.)

CALLOPHIS MACCLELLANDI (Reinhardt).

Macclelland's Coral Snake.

Of proteroglyphous colubrines, or colubrines that carry canaliculate poison fangs in the front of their maxillæ there are two sub-families, the *Hydrophiinæ* or sea snakes, and the *Elapinæ* including the cobras, kraits, coral snakes, &c. The *Elapinæ* includes 29 genera, only 5 of which are represented in India. *Callophis* one of the 5, contains 5 species according to Mr. Boulenger's classification, and 4 of these including the subject of this paper occur within Indian limits.

History.—Macclelland's Coral Snake was introduced to scientific notice by Reinhardt in 1844.

Nomenclature. (*a*) *Scientific.*—The generic name initiated by Gray is from the Greek "kalos" beautiful, and "ophis" snake. The specific title conferred by Reinhardt is in honour of Mr. J. Macclelland, a member of the Indian Forest Department, during the middle of the last century.

(*b*) *English.*—Macclelland's Coral Snake. Named in honour of the late Mr. J. Macclelland of the Burma Forest Department.

(*c*) *Vernacular.*—In the Chin Hills Captain Venning says it is one of the snakes called by the natives "sar-vut-saw."

General characters.—It is a little snake chiefly remarkable for its beautiful and very distinctive colouration. The head is flattened and broad, the snout broadly rounded as seen from above, and the neck hardly evident. The nostril is chiefly contained in the anterior nasal shield occupying about two-fourths of its depth. The suture below it passes to the 2nd labial shield, a distinctly rare condition. The eye is rather small, its diameter being rather less than half the length of the snout. The pupil is often not discernable, but in some specimens there is an arc or a ring of ruddy gold that enables one to see that it is round. The body is cylindrical, moderately robust and of even calibre throughout. The tail is short, usually being only about one-ninth to one-eleventh the total length of the snake.

Identification.—The broad enamel-white band across the head is very distinctive, and quite peculiar to this snake. The most important shield characters to pay attention to are as follows:—(1) The costals which are in 13 rows in the entire body. (2) The suture below the nostril which passes to the 2nd labial. (3) There are 7 supralabials. (4) The temporal shield touches the 5th and 6th supralabials. These points taken together will distinguish it from all other snakes within Indian limits.

Colouration.—(*A*) Variety *typica* is red dorsally, the colour varying in richness from a bright strawberry-red to cherry-red, and more rarely purplish-red. In the flanks these hues are lightest and brightest. From 16 to 35 black rings encircle the body, and 2 to 5 the tail. These rings are frequently interrupted in the flanks. The black may or may not be narrowly outlined with yellow or buff. Each ring involves about two scales in the body length. In a specimen sent me by Captain Venning from the Chin Hills, and in another obtained by Evans and me from the Pegu Yomas a series of small dorso-lateral spots were present in each interspace, and I have rarely seen a similar single series down the spine. The head is shining black with a sharply defined broad ivory-white or more rarely cream-coloured cross-band behind the eyes. The belly is saffron, and the intervals between the rings exhibit large irregularly-shaped black blotches.

(*B*) Variety *univirgatus.*—Differs from *typica* in that a black stripe runs down the spine, and the rings are frequently incomplete near the spine, especially in mid-body. The rings vary from 23 to 32 on the body and 3 to 4 on the tail.

(*C*) Variety *gori.*—Differs from the two preceding in the absence of the black rings and the spinal stripe. There is a series of 27 to 38 small black spots down the spine, usually round, sometimes rather broader than long.

The belly has irregularly-shaped median black spots smaller than in the other two forms.

(*D*) Variety *nigriventer.*—Differs from the above in having a black stripe down the spine as in *univirgatus*, but no rings. A continuous irregular black stripe passes along the middle of the belly.

Habits.—Speaking of the genus, Fayrer says: "Its representatives are sluggish, and allow themselves to be approached with little sign of fear. They are not aggressive, and bite reluctantly." These remarks certainly apply well to the subject under discussion. Venning remarks: "I could never provoke any of them to bite or show temper." The very few living specimens that have come into my hands were most inoffensive, and exhibited no temper in spite of much provocation. The "type" of *gori* resented being handled, but would not bite any object with which I attempted to irritate it. It merely flattened its body posteriorly, and when I picked it up by the neck secreted poison copiously which collected as a drop in the rostral arch. Through the drop its tongue flickered in and out tremulously.

The fact that there are no records of a bite from this snake though common enough in certain localities, seems to confirm the opinions expressed above as to its placid nature.

It is eminently a jungle as well as a hill species. In all the localities where it is met with, the country is heavily forested. The little specimen Evans and I got in the Pegu Yomas was trodden on by a wounded elephant, and pressed firmly into the soft soil. The trackers discovered it wriggling vainly to extricate itself, and it was practically undamaged. One of Venning's largest specimens was discovered on the parade ground while a game of football was in progress. It is always found in hills or in their near vicinity. For choice it inhabits a zone at an altitude of about 4,000 to 6,000 feet, but may occur lower. The specimens sent to me by Mr. Gore were from probably about 1,000 feet elevation, but quite close to outliers of the Naga Hills in Assam. Those from the Abor Hills were from a similar elevation.

Food.—Fayrer says that it feeds chiefly on snakes. I have no single record of its diet though more than 50 have passed through my hands.

Breeding, &c.—Very little is known of its breeding habits. A gravid female measuring 1 foot 11 inches that I obtained from Shillong in August 1911, contained 6 eggs, 2 in one ovary, 4 in the other. The longest of these eggs measured $1\frac{5}{16}$ inches by $\frac{7}{16}$ of an inch. When cut into they were found to contain young embryos about 1 to 1½ inches long. It is not certain however that the young are born alive, it may be that the eggs are discharged as such still harbouring young that are destined to hatch some time later, as in the case of some of the tree snakes of the genus *Dendrophis*, and the pit-viper *Lachesis monticola*. The length of the hatchling or young, as the case may be, is not known. The smallest specimen I have seen was 9¼ inches.

The anal glands secrete a custard-like material.

Poison.—Little or nothing is known about the virulence of this venom.

No case has been recorded of a bite in the human subject. Fayrer remarks that fowls succumbed to its bite.

Length.—It grows to about 2 feet, but specimens exceeding this are uncommon. I have however had a specimen 2 feet 7½ inches from Burma, and three specimens sent to me from Haka in the Chin Hills by Captain Venning measured 2 feet 5¾ inches; 2 feet 6 inches; and 2 feet 8 inches respectively.

Distribution.—From the Western Himalayas through other mountain ranges to Southern China, and Formosa.

Variety *nigriventer* (Wall).—From the Western Himalayas as far West as Kasauli. Very rare. Only one specimen is known which is in our Society's collection.

Variety *univirgatus* (Gunther).—From Nepal, through the Eastern Himalayas as far East as Sikkim. Fairly abundant in Sikkim.

Variety *typica* (Reinhardt).—Hills of Assam and Burma to South China and Formosa. Annandale has recorded it from the Abor country, Assam, North of the Brahmaputra at about 1,000 feet elevation. It is quite common in the Khasi Hills. Venning found it fairly common in the Chin Hills. There is a specimen in the British Museum from Pegu (presumably Hills), and Evans and I got a specimen from the Pegu Yomas.

I have had it from the Hills in the Southern Shan States (Mogok), and there are specimens in the British Museum from Hills in South China, and Formosa.

Variety *gori* (Wall).—Naga Hills in Assam, and Manipur. Apparently uncommon. Only four specimens are known, three were sent me from Jaipur near the Naga Hills, and one from Manipur.

Lepidosis, Rostral.—Touches 6 shields, the rostro-nasal sutures are about four-thirds the rostro-internasals, and twice or three times the rostro-labials. *Internasals.*—Two, the suture between the fellows about two-thirds that between the præfrontal fellows, and about two-thirds the internaso-præfrontal sutures. *Præfrontals.*—Two, the suture between them equal to, or rather greater than, the præfronto-frontal. *Frontal.*—Touches 6 shields, the fronto-supraocular sutures equal to, or rather less than the fronto-parietals. *Supraoculars.*—About two-thirds the length and breadth of the frontal. *Nasals.*—Two, in contact with the first three labials (rarely first two only). *Loreal.*—Absent. *Præocular.*—One. *Postoculars.*—Two. *Temporal.*—One anterior, touching the 5th and 6th labials only. *Supralabials.*—Seven, the 3rd and 4th touching the eye. *Infralabials.*—Four, the 4th largest, about as long, and twice as broad as the posterior *sublinguals*: touching two scales only behind. *Sublinguals.*—Two subequal pairs, the posterior touching the 4th, or 3rd and 4th *infralabials*. *Costals.*—In 13 rows in the whole body length; smooth; vertebrals not enlarged. *Ventrals.*—182 to 240, more numerous in the ♀. *Anal.*—Divided. *Subcaudals.*—20 to 36 pairs.

Anomalies.—It is not unusual to find a few of the earlier subcaudals entire. I have seen the last ventral divided in one specimen. The 2nd infralabial rarely fails to touch the anterior sublinguals. I have also seen a confluence of the temporal and 6th labial more than once, and a confluence of the lower postocular and 5th labial at least once.

Dentition.—(From 6 skulls in my collection). *Maxilla.*—Two strong canaliculate fangs anteriorly, no teeth behind. *Palatine.*—6 to 8, decreasing in both directions from the 3rd or 4th; grooved on their inner faces. *Pterygoid.*—2 to 6, small. *Mandible.*—9 to 11, decreasing in size in both directions from about the 4th or 5th; grooved on their outer faces.

Plate.—Our figures are good as regards colouring but incorrect in the following matters. The scale rows are shown as 15 instead of 13. The eye is too small and the iris far more conspicuously golden than is the case in life.

The second subject of this paper belongs to a family as yet not touched upon in these popular series, *viz.*, *Uropeltidæ*.

Family *UROPELTIDÆ*.

(From Greek "oura" tail, and Latin "peltis" shield, referring to the curious terminal shield peculiar to the tails of these snakes). According to Boulenger's scheme of classification this is the fifth of the nine families into which the snakes of the world are divided (Cat. Snakes in Brit. Mus. 1896). All the representatives are to be found exclusively in the Hills of Southern India and Ceylon.

The members of the family are most easily recognised by the breadth of the ventral shields which though distinctly enlarged are not twice the breadth of the last costal row. In this respect they agree with those of one other family, *viz.*, *Ilysiidae*. The snakes of the latter family however have 6 supralabials, and those of the *Uropeltidæ* only 4.

The family is sub-divided into 7 distinct genera (comprising 42 species), one of which, *viz.*, *Silybura* includes the species dealt with hereafter.

Genus *SILYBURA*.

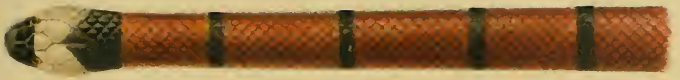
(From Greek "silubou" a thistle, and "oura" tail, in allusion to the two terminal points on the last caudal shield). At least 22 different species are known.

SILYBURA OCELLATA.

The Ocellate Thistle Tail.

History.—Discovered by the late Colonel Beddome who described it in 1863 from specimens collected by him at Walaghat in the Nilgiri Hills.

Nomenclature (*a*) *Scientific.*—The specific title conferred by Beddome is from the Latin and is a diminutive form of "oculus"



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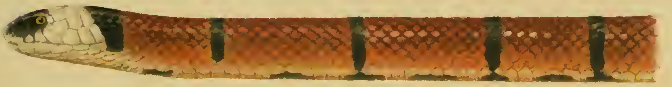

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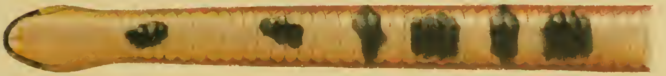

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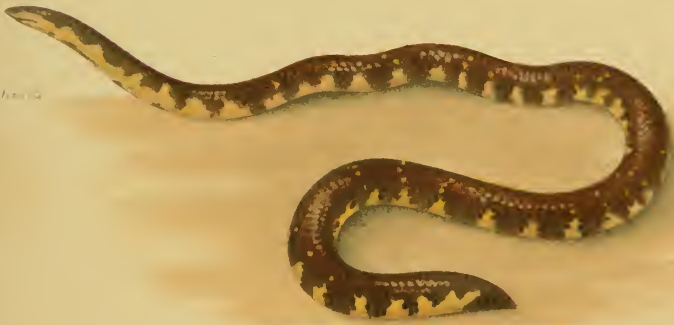

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THE COMMON INDIAN SNAKES. (Wall.)

1–3. Callophis macclellandi, var typica, *poisonous*.

4. Silybura occellata. *harmless*.

all nat size

an eye. This refers to the many little, round, yellow spots grouped so as to form irregular cross bands on the body.

(*b*) *English.*—The Ocellate Thistle Tail is the equivalent of its scientific designation.

(*c*) *Vernacular.*—Nothing distinctive is known to me.

General characters.—A small snake rarely exceeding 18 inches. The head smaller in girth than the body, tapers to an obtuse point. The nostril is open, and pierced in the front of the nasal shield. The eye is contained in the ocular shield and is small, being about one-third the length of that shield. No neck is indicated, on the contrary this region is swollen, and the body then maintains a similar calibre in its whole length. The tail is short and subtruncate and ends in two small spines placed side by side.

Colour.—The scales are olivaceous-brown, or olivaceous-green at their edges, lighter centrally. The whole body is beset with small round bright yellow spots, grouped so as to form irregular chains across the back, incorporated in rather ill-defined dark crossbars. These bars end subcostally where, many spots become confluent to form a yellow patch with an outline like a bunch of grapes. The yellow which is often a bright canary is a very unstable colour dissolving in spirit in a few hours. In some specimens I have found it so intense as to stain the inside of the skin, the muscles, and even the viscera a turmeric yellow. I have seen some specimens with the yellow adornment almost wanting.

Dimensions.—My largest specimen which came from Paralai in the Anamallay Hills measured 17⅛ inches, much the largest measurement I know. ♂ specimens frequently reach 12 to 13 inches, and ♀ 14 to 16 inches.

Identification.—The breadth of the ventrals, *viz.*, about $\frac{3}{2}$ that of the last costal row, taken with the two spines placed side by side on the terminal tail shield will establish the genus, but attention to many more points is necessary to identify the species. These are:—

(1) Costals in midbody 17.

(2) Nasals in contact behind the rostral.

(3) Diameter of eye $\frac{1}{3}$ or less than $\frac{1}{3}$ that of the ocular shield horizontally.

(4) Portion of rostral seen from above longer than its distance from the frontal.

(5) Rostral not more than $\frac{1}{3}$ the shielded part of the head.

(6) Ventrals 185 to 234.

Disposition.—I have found it a very inoffensive quiet little creature, allowing itself to be picked up and handled without trying to bite, and with very little show of displeasure. It is a restless little reptile, continually pushing its snout between the clefts of one's fingers as though seeking to hide itself. When encountered it betrays little or no alarm, and even when given a chance to burrow in loose earth only does so in a quiet leisurely fashion if it does so at all.

Habits.—It lives for choice beneath the soil but is sometimes seen on the surface or only partially submerged. It burrows in loose earth with facility using its snout only for this purpose. I frequently observed specimens in captivity, and never saw the tail used in any way as to suggest its aid in burrowing, and I failed to discover any use for this curiously fashioned appendage.

Food.—The many specimens I have dissected contained in the stomach nothing but earthworms. These are rarely found whole, but in many fragments, suggesting that the worm when seized breaks itself off by its contortions only to be seized again, and lose another instalment. The intestines and cloaca of the snake are invariably loaded with liquid mud derived from the alimentary systems of the worms ingested, and I have no doubt that every snake accounts for a large number of worms weekly.

The sexes.—Of 21 specimens from the Wynaad sexed by me 13 were ♀ and 8 ♂. The female attains to a greater length than the male. The average of my six largest females from the Wynaad was 14½ inches, against 11¾ inches for my six largest males from the same locality. The body is relatively longer, and the ventral shields more numerous in the female, and the tail is relatively shorter with fewer subcaudals in this sex. The terminal caudal shield also shows slight sexual differences. It is rather broader in the ♀, and the terminal spines less well developed than in the ♂.

Breeding.—I have lately ascertained that it is viviparous in habit. The season of birth apparently ends in July in the Nilgiris, and the brood is a small one for an ophidian, *viz.*, 3 to 5. I had two gravid mothers in July measuring respectively 14½ and 11 inches. The former contained 5 fœtuses seemingly fit for birth, the largest of which measured 4½ inches. The latter had 3 embryos, the largest measuring 4⅜ inches. In both cases these were contained in transparent membranous sacs, as one sees in vipers. No other females subsequently received (some dozens) were in a gravid state. I reckon that the smaller mother would be just about 3 years old.

Growth.—The smallest specimens I have had were about 5 inches and my notes make it appear that the young grew from 2 to 3 inches in the first year of life.

Distribution.—The Nilgiri Hills, Anamallays and conterminous Hills to the South of India between about 2,000 and 4,500 feet elevation. In the Nilgiri Hills this year I obtained 101 specimens all of which came from the Wynaad. The slopes in this locality face West, and it is perhaps remarkable that the slopes facing South and East furnished no single specimen.

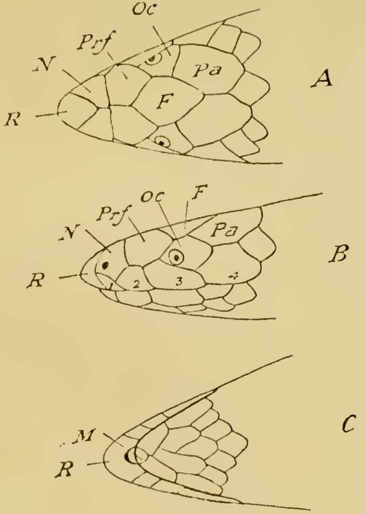
A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Explanation of Diagram.

An.	Anal.
A. S.	Anterior Sublinguals.
C.	Costals.
F.	Frontal.
I.	Internasals.
M.	Mental.
N.	Nasals.
Oc.	Ocular.
Pa.	Parietals.
Po.	Postoculars.
Pr.	Præocular.
Prf.	Præfrontals.
P. S.	Posterior Sublinguals.
R.	Rostral.
S.	Supraocular.
Spc.	Supracaudals.
Subc.	Subcaudals.
T.	Temporals.
T. Sc.	Terminal Scute.
V.	Ventrals.
1—7.	Supralabials.
I—IV.	Infralabials.

Callophis macclellandi.—A, B, C are three views of the head.

Silybura ocellata.—A, B and C are views of the head shielding. D shows the anal region with ventrals, subcaudals, and 3½ rows of costals visible on each side of the ventrals. E. View of top of tail to show the terminal scute and pluricarinate supracaudals.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Silybura occallata.
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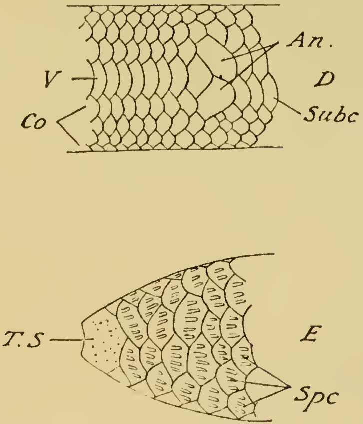
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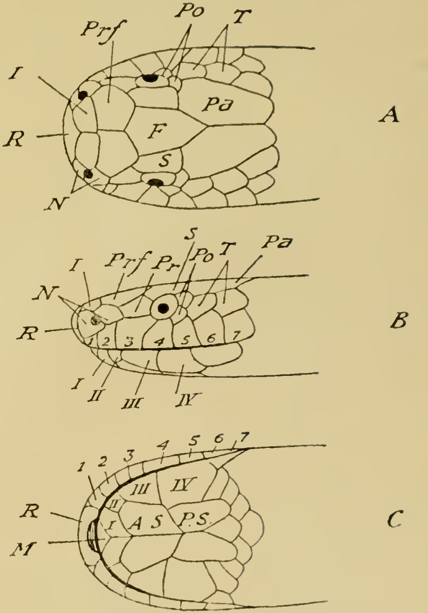
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Callophis macclellandi.
(× 2½)

The Common Snakes of India.

Lepidosis. Rostral.—Touches 4 shields, the rostro-nasal being about twice the length of the rostro-labial; the portion visible from above is greater than its distance to the frontal, and nearly one-fourth the shielded part of the head. *Nasals.*—In contact behind the rostral; touching the 1st and 2nd labials. *Præfrontals.*—In contact with the 2nd and 3rd labials. *Frontal.*—In contact with 6 shields; about as long as the parietals. *Ocular.*—In contact with the 3rd and 4th labials. *Supralabials* 4; the 4th longest. *Sublinguals* absent. *Mental groove* absent. *Costals.*—Broader than long, smooth, with rounded outlines posteriorly; 19 (rarely 21) two heads-lengths behind the head, 17 (rarely 19) in midbody, and 17 (rarely 19) two heads-lengths before the vent. About three heads-lengths behind the head, the rows reduce to 17 by a fusion of the 4th and 5th rows above the ventrals. About three heads-lengths further back the 4th row again divides to establish, 19 for a few rows, and again about two heads-lengths further back the 4th row is again absorbed, and the scale rows then remain 17. *Ventrals.*—About $\frac{3}{2}$ the breadth of the last costal row. In Wynaad specimens they number 185 to 197 in the ♂, and 194 to 208 in the ♀. In Anamallay specimens they range from 214 to 231 in the ♂, and from 218 to 230 in the ♀. *Anal.*—Divided; about twice the breadth of the ventrals. *Subcaudals.*—Divided; 9 to 12 in the ♂, and 6 to 8 in the ♀. *Supracaudals.*—The scales on the subtruncate part of the tail have many keels. *Terminal shield.*—Large and furnished with two points placed side by side.

Anomalies.—One specimen obtained at Paralai had 21 scale rows anteriorly and 17 at midbody and behind. I considered this merely an aberrant specimen of *ocellata* and sent it to the British Museum where my view was confirmed.

I have seen the last ventral sometimes divided.

Dentition.—The maxilla supports 4 to 5 teeth. There are no palatine, or pterygoid teeth. The mandibular series numbers 6 or 7.

(*To be continued.*)

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. BELL, I.F.S.

(Continued from page 453 of Vol. XXV.)

PART XX.

7. Genus—CHILADES.

There are only two species belonging to this genus and they are both fairly widely distributed, *laius* over the whole of India, Ceylon and Burma, *trochilus* inhabiting the same places with Europe, Africa, Asia Minor, Persia to the west in addition as well as the Malayan sub-region and Australia; the former also extends into China. The former is more of a jungle insect, the latter is found in the driest regions; the transformations of both are known and will be found below; the larvæ of both are attended by ants; that of *laius* feeds upon Limes, of the other upon *Lotus corniculatus.* Colonel Bingham says that the genus is "very closely allied to *Lycæna*, from which the two forms that are placed under it are kept separate, more for convenience and because of the character of the wing-markings on the underside and the peculiar range of the forms, than for the slight structural difference of veins 3 and 4 of the hindwing being both emitted from the lower apex of cell."

142. Chilades trochilus, Freyer.—Male *Upperside*: brown, somewhat variable in tint. Specimens from dry localities are much paler than those taken in areas with a comparatively heavy rainfall. Fore wing: uniform, with a very ill-defined anticiliary dark line in some specimens. Hind wings: a subterminal series of round black spots crowned with pale ochraceous, orange or even, rarely white; the posterior four spots generally well defined and outwardly edged with white; the anterior spots obsolescent and without the interior edging of yellow or the outer edging of white; a well marked slender anticiliary black line. *Cilia* white, basal halves brown. *Underside* pale silky brown. Fore wing: with the following white markings:—a short line on the inner and outer sides of the discocellulars; a transverse, slightly curved, discal series of small, sometimes more or less incomplete rings; a transverse, postdiscal series of disconnected slender lunules; a sub-terminal series of similar but more regular lunules and a terminal broken line, followed by a dark unbroken anticiliary line; the ground-colour between the two short discocellular lines, that enclosed within each ring of the discal markings, and between the subterminal lunules and the terminal line slightly darker than on the rest of the wing; sometimes nearly black between the upper three or four pairs of discal lunules. Hind wing: two short white lines on the discocellulars; the discal, postdiscal and terminal markings as on the fore wing, except that enclosed between the subterminal series of white lunules and the terminal white line is a complete series of dark spots, the posterior three or four jet-black sprinkled outwardly with metallic-green scales and encircled with pale ochraceous. In addition there are a transverse subbasal series of four white-encircled black spots and a similar subcostal spot in middle of interspace 7. Antennæ, head, thorax and abdomen brown, the shaft of the antennæ speckled with white beneath: palpi, thorax and abdomen white. Female. *Upper* and *Undersides*: ground-colour and markings as in the male, but the latter larger and more clearly defined; on the hind wing the yellow crowning the black spots on the tornal area on the upper side and surrounding the same on the underside, wider and more prominent. Antennæ, head, thorax and abdomen as in the male. Expanse: Male and female, 17·25 mm.

Larva.—Shape, that of the normal *Zizera*, *Nacaduba*, &c. The ventrum is flat, the dorsum rounded, the sides sloping, the segments somewhat constricted, especially on the dorsum; segment 2 semi-circular in out-line thickened round the free margin, the dorsum with the usual diamond-shaped depression at each lateral corner of which is a single, erect, short hair; the rest of the segment covered with small, porrect, darkish hairs along the free margin and minute, sessile, star-topped hairs on the rest, the bottom of the depression being smooth and occupying nearly half the width and length of the segment; anal segment parabolic in out-line, dorsally more or less flat, sloping to hinder margin; segments 11, 12, 13 are also rather flattened dorsally and slope similarly to the anal one; the larva is broadest at segment 5, thence gently narrowing to anal end The head is large and generally kept hidden under segment 2; round, smooth, shining, black or very dark brown; labrum and antennæ white; clypeus triangular. The surface of the body is covered more or less thickly with minute, white, sessile, star-topped hairs and there is a subdorsal line of erect or, sometimes, slightly curved, simple, longer hairs as well as a similar line along the dorsoventral margin: all more or less white; the circular organ-holes on segment 12 are present, large and orange in colour; the transverse, mouth-shaped gland on segment 11 is also very evident. The spiracles are small, nearly round, white and flush with the general surface. The colour of the body is green, rendered hoary by the presence of the white-topped hairs; with a subdorsal, white line, the dorsum above it (or them, as there are of course two) dark-green and a subspiracular, white line all along the dorsoventral margin; in between the subspiracular and subdorsal lines there are two, indistinct, parallel. white, diagonal lines running from anteriorly above backwards towards the hinder margin of each segment 3 to 10; ventrum green with the sides also set with star-topped, white hairs. L: 9 mm.; B. 2·75 mm.

Pupa.—The pupa is of the usual type belonging to the larva; it is neither very stout nor yet very narrow; it is constricted dorsally behind the thorax though not laterally; it is broadest at segments 7, 8: it has the anal end rounded and segments 13, 14 turned under; the sides from the somewhat prominent shoulders backwards to segment 6 are nearly parallel; the thorax is distinctly humped and inclined to be keeled in the dorsal line with the hinder margin a somewhat narrow curve making an angle with the wings which is rounded and open; segment 2 is a nearly perfect oblong in shape seen from above, the head just showing in front of it as a short convexity, thus making the front of the pupa rounded; the frons is in a plane at right angles to the longitudinal axis of the pupa and is high. The surface is shining and smooth except for a lot of minute tubercles, each bearing a single, short, erect, white hair; there are also some hairs on the margin of the mouth in front; there are none on the wings. The spiracles of segment 2 are light brown, linear ovals; the rest are small, nearly round, very slightly prominent and yellowish in colour. The colour of the pupa is plain grass-green. L: 11·5 mm.; B: 2·25 mm.

Habits.—The eggs are deposited singly in the axil of a leaf or on the underside of one, or on a flower or fruit. The larva lives anywhere on the plant when it is full-grown and is intermittently attended by ants of the genus *Prenolepis,* probably also by others; but the imagines always seem to choose plants with ants on them for ovipositing. It was noticed that, in Sind, a species of the hymenopterous genus *Ammophila* takes large toll of these caterpillars to bury in the ground in burrows prepared for the purpose. The wasp stores a certain number at the bottom of the hole, lays one egg amongst them when it judges there are sufficient to satisfy the resulting grub and then closes up the passage with earth, always finished off, to more effectually hide the mouth or opening (?) with a small piece of stone or shell. The butterfly is one of the very smallest of the *Lycænidæ,* easily distinguished from all others by the prominent, marginal row of 3-6 more or less round, black spots on the underside of the hindwing, each spot speckled with metallic-green. It inhabits desert tracts and regions of heavy rainfall, jungles and open country, plains and hills, but does not seem to occur at any great elevation. It is a weak-flying insect and never rises any great distance from the ground, it settles frequently on low herbage, diligently visits flowers and rests in the usual manner with closed wings but sits often with them well opened basking in the sun. It is fond of open spaces wherever it occurs and loves the sun at all times. The foodplant of the larva is *Lotus corniculatus.* De Nicéville also gives *Heliotropum strigosum* which often grows with *Lotus.* The distribution of the insect is: throughout British India; South-eastern Europe; Africa; Arabia; Central Asia; and through the Malayan Sub-region to Australia.

143. Chilades laius, Cramer.—*Wet season brood.*—Male *Upperside*: bluish purple. Fore wing: base and basal half of costa flushed with pale blue costa and termen edged by a slender dark brownish-black even line, beyond which along the termen the *cilia* are brown at base, white outwardly. Hind wing: costa somewhat broadly dusky black; a slender black conspicuous anticiliary line, beyond which the *cilia* are white traversed medially by a brown line; dorsum broadly pale brown, two subterminal pale bordered black spots in interspace 1, and one similar spot in interspace 2, often obsolescent and barely indicated. *Underside*: grey. Fore wing: a transverse broad lunule on the discocellulars and a transverse discal series of six spots dark brown, the lunule and each of the discal spots edged with white; the posterior four spots of the discal series elongate and each obliquely placed, the anterior two round and curved inwards: a subterminal series of transverse elongate spots with an inner series of lunules dusky brown, both series edged inwardly and outwardly with white; finally, an anticiliary slender black line. *Cilia* white, medially traversed by a dark brown line. Hind wing: the following jet-black spots slenderly encircled with white:—a transverse subbasal series of four and a subcostal spot somewhat larger than the others in the middle of interspace 7: below the latter a catenulated line of slenderly white-edged dusky-brown spots, including the lunular spot on the discocellulars, crosses the wing, and beyond these opposite the apex of the cell are three similar discal spots, the middle one elongate; the terminal markings consist of an inner continuous subterminal series of dusky lunules, bordered inwardly and outwardly with white, an outer subterminal series of inwardly conical dusky-brown spots, and a slender anticiliary black line. The posterior two spots of the outer line of subterminal markings are also black. *Cilia* white. Antennæ black; the shafts ringed with white; head, thorax and abdomen brown, the head, thorax and base of the abdomen with a little blue scaling; beneath: the palpi, thorax and abdomen white. Female. *Upperside*: dark brown. Fore and hind wings from their bases outwards to a varying extent shot with bright iridescent blue, this colour not extended on either wing to the costa, termen or dorsum. Hind wing: in addition a curved postdiscal series of whitish lunules very often obsolescent, in some specimens entirely wanting; followed by a subterminal series of black, narrowly white-encircled spots that are often obscure and in some specimens do not reach the apex. Anticiliary black lines and *cilia* as in the male. *Underside*: precisely similar to that of the male. Antennæ, head, thorax and abdomen as in the male.

Dry-season brood.—Male and female. Closely resemble specimens of the wet-season brood, but can always be distinguished by the somewhat paler ground-colour of the upperside, while on the underside both sexes bear a large nebulous brown patch on the hindwing posteriorly. Sometimes the ground-colour on the underside is much paler, almost white, especially in the female. Expanse: Male and female, 28·-32 mm.

Larva.—Of the usual normal shape of *Nacaduba*, &c. Head black, smooth shining. The constrictions between the segments slight; the usual gland and extensile organs present. The surface of the body but very slightly, shagreened, covered with extremely fine and short, downy hairs. Colour green of the shade of the lime leaves it feeds upon; a dark green dorsal line; a pale, subdorsal line and a similar, subspiracular one. L: 10 mm.

Pupa.—Of the *Nacaduba* type, with a dorsal and lateral series of somewhat obscure, conjoined, brownish spots on the dorsal region; otherwise plain green.

Habits:—The above description of larva and pupa is taken from de Nicévilles Butterflies of India, Burma and Ceylon. The following habits have also been noted by that author:—The larva feeds upon the young leaves of Lime and Pomelo. The pupa is formed on the undersides of leaves and is quite normal in its attachment. The butterfly is found in Báluchistan; N. W. Himalayas, not ascending above 6,000 or 7,000 feet; N. W. Provinces, eastwards to Bengal and Assam, southwards through Central, Western and Southern India to Ceylon; Burma; Tenasserim; Southern China.

8. Genus—TALICADA.

The genus consists of a single species confined to Western and Southern India; Ceylon, Assam and Upper Burma. The sexes are absolutely similar, the upperside glossy black with a large vermillion, anal patch on the hind wing and the *cilia* chequered black and white; the underside is white with black spots and bands. The larva is peculiar in that it feeds in the inside of leaves of *Bryophyllum calycinum* and *Kalanchoë* of the order *Crassulaceæ*, the home Stonecrops. It is hardly ever attended by ants. The flight of the butterfly is weak: it never rises high and does not often come to flowers. It is found from sea-level up to, at least 2,500 feet and slightly over.

144. Talicada nyseus, Guérin. Male—(Pl. G. fig., 46)—and Female. *Upperside*: black or brownish black, in fresh specimens in certain lights with a dull purplish flush. Fore wing: uniform, with a very slender thread-like edging of white to the costa. Hind wing: a large conspicuous orange-red patch on the posterior terminal half of the wing between the dorsum and vein 7; this patch does not extend quite to the termen but leaves a narrow edging of the black ground-colour which is produced inwards in short conical projections in interspaces 2 to 5. *Cilia* of both fore and hind wings chequered with black and white alternately. *Underside*: silvery white. Fore wing: a short line under the costal vein from base; a quadrate spot on the discocellulars; a broad, transverse, discal band and the terminal third of the wing: jet-black; the discal band is irregular, dislocated on vein 3, the posterior portion shifted inwards and joined on to the black area on the posterior terminal third of the wing by projections of black on the dorsum, along veins 3 and between veins 4 and 5; the black area on terminal third of the wing encloses a transverse, postdiscal series of small, round and a subterminal, transversely-linear series of spots of the white ground-colour. Hind wing: one spot at base, a subbasal transverse series of three spots; a medial, similar series of four somewhat elongate spots and a transverse, short, postdiscal bar between veins 4 and 6, and, often, some postmedial, further dots jet-black; terminal third of the wing above vein 7 jet-black, below that vein deep orange-red, the whole area (both the black and the red) medially traversed by a transverse curved series of round spots of the white ground colour and margined outwardly by a series of transverse, very short and very slender lines of the same in the interspaces: anticiliary line black. *Cilia* of both fore and hind wings chequered as on the upperside; a short filamentous tail at apex of vein 2 black, tipped white. Antennæ, head thorax and abdomen black, shaft of the antennæ ringed with white; beneath: palpi, thorax and abdomen white. Expanse: Male and female, 33·42 mm.

Egg.—Turban-shaped, covered on the sides with rough, convex, roundish excrescences, each one with a depression in the middle and each connected with the immediately surrounding ones by fine low ridges; the top of the egg is nearly flat and is finely reticulated except in a small, central area which is slightly raised and smooth. The colour is light enamel-green, the ridges and excrescences pure white. B: O. 8 mm.

Larva.—The shape is that of *Nacaduba* more or less, but is somewhat flattened. It is broadest at segments 8 and 9, although nearly of the same breadth from 3 to 10; highest at segment 7; anal segments flattened, anal segment itself rather square at extremity; each segment has a lateral depression parallel to its margin, the 3rd and 4th being dented also in the dorsal line more or less circularly, giving these two segments a depressed appearance in that region. Surface covered with sparsely disposed, short, light hairs which are longer round the body margin. Spiracles conspicuous being rather large, quite circular and deep black. Colour shining translucent-looking yellowish white, nearly transparent on the margins of the body; ventrum the same colour. L: about 10 mm; B: 3 mm.

Pupa.—Rather narrow but, on the whole, normal and like the *Nacaduba* group. Head hidden from above; segment 2 rounded in front; thorax is convex and slightly compressed; the constriction at segment 4 is slight dorsally and still less laterally; transverse section of abdomen nearly circular, slightly depressed ventrally; anal end rounded; broadest at segments 7 and 8; highest at thorax. Surface of the body clothed with compratively long, light-coloured, diffuse, erect, translucent hairs all over except on the wing-cases. Spiracles of segment 2 are indicated by longly oval, raised, light coloured, low risings; the others are longly oval, light in colour—the colour of the body. The colour of the pupa is a light cream with two black spots at each shoulder, another, dorsal, at the hinder margin of segment 2, a lateral black spot near the anterior margin of thorax, a lateral, central one on segment 4; a lateral and dorsal one on each of the segments 5 to 10, two central spots on segment 11; abdomen darker in colour than the rest, ventrum lighter. L: 11 mm.; B: nearly 4 mm.

Habits:—The egg is laid, one at a time, on a leaf stalk or on the stem; sometimes, even on a dry leaf on the ground near the plants which are always gregarious. When the little larva emerges it immediately bores into one of the flat leaves and, during the whole of its life, lives between the upper and under cuticles, mining the soft tissue between and only coming out to pupate. Its habits of internal feeding accounts for its livid colouring; the passages which often widen out and disappear in wholesale mining, are always damp and dirty as the excremental refuse remains where it is deposited. The larva shams death when taken out of its leaf and is then quite hard to the touch. It is only rarely attended by ants. The pupa is often attached to a leaf, either on the upperside or underside; but it may be found anywhere in the vicinity of the plants and is strongly attached by the tail and a body-band. The stages are rapidly passed through and the butterfly emerges generally in the morning as do, indeed, nearly all the *Lycænidæ*. It is a somewhat weak-flying insect and never rises far from the ground, upon which it frequently settles. It invariably rests with the wings closed over the back and always upon the upper surface of whatever it alights upon; it is found always in the neighbourhood of the foodplant where it flies about in the undergrowth for quite long periods without coming to rest. It is extremely plentiful wherever it exists and prefers shade to the bright, hot sunlight. The foodplant it has been bred on is *Bryrophyllum calycinum*, of the Natural Order *Crassulaceæ*, the Stonecrop Family. The plant grows in shady places all over the Presidency of Bombay from sea-level upwards and may be recognized at once by its succulent, opposite leaves with crenate margins which, if placed on moist soil, produce new plants from the notches round the margins; by its large terminal, erect panicles of greenish-purple, pendulous rather large, oval shaped flowers with large, inflated calyces; and by these flowers-"popping" when squeezed between the fingers. De Nicéville says the larva feeds also upon *Kalanchoë*, another member of the same family. The presence of the larva can be easily seen by the withered look of the leaves with the inside eaten out of them. The insect is found in Central, West and Southern India; Ceylon; Assam and Upper Burma. The figure 49 on plate G, published at page 482, Vol. XXIII, is a very successful representation of the insect.

9. Genus—LYCÆNESTHES.

There are only two species belonging here and both exist, practically, throughout India and right away through Burma to Australia; more particular details are given under the species. The genus is characterised by having three very short tails to the hind wing, hardly more prominent than the *cilia* or fringe-hairs—they are, in fact, slightly elongated *cilia*. The two species differ in shape and have slightly differently shaped larvæ and pupæ also. De Nicéville says "The venation of this genus is most ordinary; it does not present a single peculiarity, nor has the male any secondary, sexual characters." (Butterflies of India, Burmah and Ceylon). He also informs us that there are 29 species in the genus, mostly from Africa, but that a few are from the Malayan Archipelago. The transformations of both our species are known. The larvæ are both attended by ants, that of *emolus* always and constantly by *Œcophylla smaragdina*, that of *lycænina* very occasionally by *Camponotus*, *Œcophylla* and others. The butterflies are both strong fliers and the males bask on the upper surfaces of leaves on the tops of the high trees; both sexes come sparingly to flowers and may be seen sucking moisture from damp places on the ground on hot days at the beginning of the monsoon and just before it. They rest with the wings closed over the back but bask with them partially opened. Both the species are not at all uncommon in the Kanara District of the Bombay Presidency but are more or less confined to the hilly parts from sea-level upwards.

145. Lycænesthes lycænina, Felder.—Male. *Upperside* : purplish-violet ; in certain lights with a bluish shade because of a covering of appressed, white, longish hairs all over the disc of both wings, leaving only the costal and terminal margins bare. Fore wing : a narrow decreasingly broad costal margin bare of hairs and, therfore, darker looking ; the apex itself again more broadly bare decreasing to tornal angle ; deep blue at base where the hairs are also much longer below vein 1 and a fringe along inner margin. Hind wing : similar, but the hairs are much more sparse on the disc, longer again below vein 2 ; costal and abdominal and inner margins brown, the former bare, the latter clothed with long, white hairs ; a faint, blackish spot near the margin in interspaces 1 and 2. *Underside* : light satiny brown with white, transverse lines on both wings and black spots on the hind wings. Fore wing : a short line on each side of the discocellular nervules ; a medial, lunulate, line in continuation of the outer discocellular line down as far as vein 1a ; a postmedial, lunulate line from costa to vein 1a : all more or less parallel to, and equidistant from, each other ; another, further out, also equidistant and parallel, from costa to vein 3 ; all the lunules outwardly convex ; a subterminal, complete, transverse series of lunules inwardly convex-angulate and a pair of terminal lines, the inner more or less lunulate, the outer faint, broken and straight ; and deep brown line or narrow band before the *cilia* ; the *cilia* brown except in interspace 1a where they are white—the colour of the wing below vein 1a is itself white. Hind wing : a black, white-ringed, subbasal dot or spot in interspace 7 touching vein 8 ; another, similar, on inner margin ; a minute, black spot nearly blinded by the surrounding, white scales at the anal angle in interspace 1a ; a larger one, submarginal, in interspace 2 crowned interiorly by an orange lunule and margined exteriorly by plentiful, white scaling ; the following markings, beginning from outside : *cilia* golden light-brown with extreme base pure white ; a narrow, brown, anticiliary line finely bordered inside with white ; then a series of inwardly angulated lunules from anal margin to interspace 5 ; followed by another series of similar lunules in the same interspaces, these two series enclosing the orange-crowned, black spot in interspace 2; and the following pairs of lunules in the specified interspaces, the outer one convex outwards, the inner concave, each pair forming a sort of broken ring : in interspace 1a : one pair near the middle ; in interspace 1 : 2 pairs, one postmedial, the other antemedial ; interspaces 2 and

3 : one pair in each at the base ; interspace 4 : three pairs, one basal, one medial, one postmedial ; interspace 5 : two, the one at middle, the other postmedial ; interspaces 6 and 7 : two, one at base, one subterminal ; all these broken rings forming irregular efforts at transverse bands. Head above dusky, the eyes ringed with white, the frons dusky black ; thorax black with long, appressed hairs, blue in front, white behind ; abdomen black powdered with white scales ; palpi : black. Below : abdomen and thorax whitish, the former with long hairs ; palpi speckled black and white on end joint ; white on second joint. Antennæ black, finely ringed white ; club long, orange on the inside. *Cilia* with the basal half brown, preceded by an anticiliary, brown line ; the extreme half grey. Female. *Upperside* : hair-brown with a slight bronzey lustre, darkest along costa, the base of wing powdered with violet-blue scales getting sparser outwards to a varying extent but always leaving a more or less broad, costal margin and a rather broader, terminal margin of ground colour ; a slight anticiliary, dark-brown line or narrow band. The discs of the wings have no appressed hairs. Fore wing : *cilia* with basal half the colour of wing, the outer half dark-grey. Hind wing : similar to fore wing but at the anal angle the anticiliary, brown band or line finely bordered bluish-white in interspaces 1, 2, 3 ; a dusky spot, faint in 3, each one finely margined bluish-white inwardly ; a fringe of *cilia*-like, fine, white hairs along inner margin and some appressed, white, longish hairs on hinder, basal area. *Underside* : darker brown than in the male with no satiny gloss ; markings similar but plainer ; sometime, on the hind wing, some black scales at the outer margins of interspaces 1 and 3 as well as the black spots in 1a and 2 ; also the terminal, white, fine line bordering the anticiliary, brown line, is continued to the costa and the *cilia* are more largely white at base. Head and eyes, thorax and abdomen as in the male ; antennæ with hardly any orange on the club. The wings similar in shape with the same tufts at ends of veins 1-4 of the hind wing. Expanse : 28·32 mm.

De Nicéville says : " *Lycænesthes lycænina* may be usually known from *emolus* in the male by its brighter and lighter purple coloration on the upperside ; the apex of the fore wing is more acute, the outer margin straighter ; in the hind wing the outer margin seems to be truncated, the anal angle acute instead of being rounded. On the underside the markings are usually more prominent, the discal band in both sexes on both wings is more or less broken in the middle, very markedly so on the hind wing, while in *emolus* it is continuous. In *lycænina* there is almost always a black spot near the base of the hind wing touching vein 8 which is never present in *emolus* ; this spot is often small and inconspicuous, sometimes absent altogether ; similarly also the subanal, black spot is sometimes entirely absent ; and this latter variation has been described as a distinct species by Mr. Moore (*Lycænesthes orissica*, Moore, Journ. A. S. B., vol. iii pt. 2, p. 23.) Habitat : Orissa. Expanse : Male, 9·9 of an inch equalling 22·5 mm. It is always a fact that, in undersized specimens, spots and markings tend to disappear. Colonel Bingham says : " the short band on the discocellulars and the anterior portion of the discal band form two branches, the lower portion of the discal band the stem, of a rough Y-shaped figure" which they do, distinguishing the species at once from *emolus*.

Larva.—This is of the ordinary wood-louse, *shape*, rather broad and stout, and has each segment prominently swollen-looking, this being caused by each segment rising from the front margin to the hinder margin where it suddenly falls again : the thickening is rounded and not angled anywhere and is most prominent between the dorsolateral lines on the dorsum, for below that region the surface is more or less flat though still somewhat higher than the actual margins of the segments ; the anal end shelves from the gland on segment 11; segments 12-14 are one piece with the divisions invisible, the slope being at an angle of about 30° with the longitudinal axis; the extremity is broadly rounded. Besides the rather small, transverse gland on segment 11, the two small extensile organs on segment 12 are also present, the openings being circular and in the usual position; segment 2 is semi-circular in outline and has the usual dorsal depression which is shallow; segment 3 has the thickening from the hinder margin forward instead of *vice-versa* as in the other segments so that it overhangs segment 2. *Head* small, round, light-yellow in colour, very smooth and shining—the clypeus is triangular, the jaws and eyes dark red-brown and black respectively. Surface only slightly shining, covered with minute, short, light, semi-appressed hairs all over, these hairs with thickened bases and only visible with a strong lens; some longer hairs round the front margin of segment 2 and round the extreme margin of the anal flap; there is a small, round depression on dorsum of each segment 3-5, another on the front margin of segment 2 and a lateral, longitudinal depression on, and parallel to the margins of segments 3-6. The spiracles are small, flush, round, white in colour and are situated well above the dorsoventral line. The colour is enamel-white with a dark-green, dorsolateral triangle with its base on the front margin of each segment, the apex running back in a thin band to join a green band along the hinder margin of the segment from the dorsolateral region to the dorsoventral line: this band about one-quarter as wide as the segment is long; besides: a dorsal, green triangle on each segment, its base on the front margin, not reaching the dorsolateral line or triangle, its apex situated about the middle of the segment; the upper side of dorsal triangle bordered thinly maroon; also a maroon spot at the bottom of the band along the hinder margins of the segments near the dorsoventral margin and a maroon, thin, dorsal line, interrupted on the green triangles; ventrum light-green.

Another larva was dark-green with a deep rose-coloured but rather fine, very distinct, dorsal line; a large, triangular, greenish-yellow, subdorsal patch touching the dorsal line in one basal angle at hinder margin of each segment 3-10, each triangle bordered below narrowly by deep rose-colour; a subspiracular, yellow band interrupted at segment-margins by a deep rose-coloured mark on segments 4-10; the dorsal line extends from segments 3 to anal extremity. L: 16 mm.; B: 3·5 mm. at segment 7 which is the broadest part.

Pupa.—The pupa resembles that of *Lycænesthes emolus* in general appearance except that it is more robust than that, more compact. The diamond-shaped mark on the hinder dorsal slope of the thorax is also present—indeed it is this mark which makes the resemblance so striking. The body is blunt in front, the vertex of the head being flat and in a plane at right angles to the longitudinal axis of the pupa; the head is quite invisible from above: segment 2 is more or less semi-circular in outline as regards the front margin though somewhat adapted to fit the flat head-surface; the dorsal slope of segment 2 is ascending at an angle of about 45° to the longitudinal axis and is the same as the slope of the anterior part of thorax; the thorax is but little humped, its highest part being very close to the hinder margin, the fall to segment 4 being sudden though small; there is no constriction worth the name at segment 4 either dorsally or laterally; the broadest part is at segment 7 though there is very little difference anywhere between that and the shoulders; the anal end is somewhat broadly rounded. The *surface* of the body is covered with very minute, white tubercles. not particularly dense. The *spiracles* of segment 2 are narrow, white slits, the rest are slightly raised, oval and white. The *colour* is green with a dorsal, thoracic, yellow line, the thoracic, dorsal diamond-mark being yellow margined with brown ; a lateral, interrupted, yellowish line ; ventrum whitish ; margins of segments 1-2 and 2-3 and the wings show whitish-yellow ; the whole pupa more or less spotted. L: 10 mm.; B: 4·5 mm at middle, 4 mm. at thorax-apex.

Habits:—The egg is laid on a flower or in the axil of a flower-stalk and the larva at first bores into a flower-bud but afterwards lives outside, generally curled round a bud, feeding on it ; and it is very difficult to see owing to its patchy colouration. It pupates amongst the flowers or on a flower-stalk, or on a leaf, fixing itself by a body-band and the tail. The larva is not much attended by ants and does not seem to be in any way dependent on them ; these insects do, however, occasionally visit it—which, of course, besides, is proved by the existence of the gland and extensile organs. The butterfly is a strong flier and frequents the tops of trees rather more than the lower places. The foodplants of the larva are *Wagatea spicata* (*Leguminoseæ*) and *Buchanania latifolia* (*Anacardiaceæ*), the one an extensive, thorny climber with long spikes of scarlet and yellow flowers known in the vernacular as Wagati ; the other a small tree of not much worth, with large leaves and masses of small, greenish-white flowers when in bloom, called Char or Charoli in marathi and Nurkal in kanarese. Both these plants are often infested with red ants from which may be gathered the fact, as they are so far apart botanically from each other, that the butterfly is guided, in the choice of a place for its eggs, more by the presence of these insects than by the species of the foodplant of the larva, which seems curious considering the casual way in which the ants attend the latter. The butterfly is a powerful flier resting on the leaves of high trees, basks with the wings half opened, sits with them closed over the back in the normal way ; is often to be found sucking moisture from damp places on the ground and is occasionally met with on flowers. It has a wide distribution : Sikkim ; Bengal ; Orissa: Western and Southern India ; Ceylon ; Assam ; Burma ; Tenasserim ; Siam ; the Malay Peninsula and Borneo. It is probably more or less confined to the hills.

146. Lycaenesthes emolus, Godart.—Male. *Upperside* : bright, shining purple in certain lights ; duller in others, the wings more rounded on the outer margins than in *lycænina*, the tufts of hair at the ends of veins 1-4 of the hind wing less developed ; no appressed, white hair on disc of fore wing but the cell of hind wing and below vein 1 clothed sparsely with such ; the *cilia* perhaps browner than in *lycænina*, otherwise everything as in that species. *Underside* : darker brown with no lustre, marked with white, transverse lines on the fore wing and black spots in addition on the hind wing. Fore wing : a white line on each side of the discocellulars ; a pair of straight or lunulate, parallel lines, forming a postmedial, outwardly convex band of the same width as the distance between the discocellular pair of lines and about the same distance removed from the outer of these ; in each of the interspaces 1-7, arranged in detail as follows : in interspace 1, both parallel, straight, directed diagonally outwards, in interspace 2 erect, parallel, also straight, in continuation of these : in 3, both outwardly convex, parallel, the inner one in continuation of the outer of interspace 2 ; in 4, the outer outwardly convex, the inner outwardly concave and from a point half way between the pair in interspace 3; in interspaces 5, 6, 7, the lines in continuation of each other, the outer convex outwardly, the inner concave outwardly, the outer continuous with the outer line of interspace 4, the inner originating from a point further in than the inner line of interspace 4 ; the spaces included between these pairs of lines darker than the ground-colour : afterwards : a narrow, dark-brown band or broad line, transverse, submarginal, bordered outside by a fine, white line ; the margin beyond dusky, followed by the anticiliary blackish line and the brown *cilia*. Hind wing : the same black white-ringed, subbasal dot or spot on the inner margin as in *lycænina*—the costal spot of that species is never present here ; neither is the minute, black spot at the anal angle in interspace 1a ; instead of that there is one in interspace 1 not to be found in *lycænina* ; the black, orange-crowned spot in interspace 2 present ; and the following white, transverse, lines arranged in pairs in the interspaces as follows :—subbasally in interspaces 1, the cell and 7, a pair in each, the inner line of the first being continuous with the outer line of the pair in the cell, the outer one of the pair in the cell, continuous with the inner line of the pair in interspace 7, the pair in the cell besides converging strongly upwards : medially, a pair formed by a white line on each side of the discocellular nervules ; postmedially, a somewhat irregular band composed of pairs of lines in the interspaces as follows : in 1a the two straight, parallel, slanting down from below the subbasal black spot on inner margin ; in interspace 1 a pair at right angles to the veins and in continuation with those of 1a ; in 2 the lines slightly convex outwards, the inner angulate, and continuous with the outer of interspace 1 ; in 3 a short pair at the base of the interspace, the inner angulated and starting from between the pair in interspace 2, the outer convex outwards and starting further out than the outer one of that interspace ; in 4 and 5 the lines continuous, both outer ones convex outwards, the inner concave outwards; and starting slightly further out than the inner of interspace 3 : in 6 both outwardly convex, parallel, the outer starting between the two of 5, the inner further in than the inner of 5 ; in 7 exactly the same with regard to those of 6, that is, both convex outwards, parallel and moved inwards ; after these markings there are two complete series of subterminal, white, angulate lunules concave outwards ; a brown anticiliary line bordered on each side by a fine, white line, the outer of which is formed by the white bases of the *cilia*, but ends at vein 3 after which the bases of these is dusky as a rule, the outer portion greyish—but this varies in different specimens. Head dusky on vertex, the frons black, the eyes bordered, thinly pure white ; thorax black clothed with long, appressed hair which is dark in front, bluish behind ; abdomen black ; palpi black. Beneath : palpi with the end joint black, the second white, fringed with black ; thorax covered with bluish-white, longish hair ; abdomen whitish. Antennæ black, thinly ringed with white ; the club orange inside and at tip. Female. *Upperside* : brown, the basis of the wings glossed with pale violet-blue on the fore wing ; in some specimens extended for two-thirds the length of the wing but leaving always more or less of a broad margin of ground-colour along the costa, a still broader margin along the termen and a narrow edging (often none) along the dorsum ; on the hind wing the blue rarely extends beyond the basal third. Head, thorax, abdomen, palpi the same as in the male but the black replaced by brownish. Expanse : 29—35 mm.

The species is more constant in markings than *lycænina*. Colonel Bingham says, in describing the transverse band formed by the subbasal pairs of lunules on the underside of the hind wing that each lunule touches "the corresponding lunule of the line next it on the inner side, so that in each interspace the two touching lines of lunules seem to form a series of markings like X", which is characteristic of the species.

Larva.—In *shape* this larva is somewhat abnormal and rather like that of *Arhopala centaurus.* The breadth gradually increases from segment 3 to segment 10 after which it decreases again to the anal end which has the extermity semi-circularly rounded rather broadly; these last segments 12-14 being flattened dorsally with the slope at about 30° to the longitudinal axis of the body: there is, however, nowhere any very great difference in breadth; the highest part is about segments 7-9 (varies with the position the larva assumes; this being the normal one when it is neither stretched nor contracted); the segments are not anywhere constricted; the *head* is hidden under segment 2, is small, nearly round in shape, shiny green or greenish yellow in colour; segment 2 is rather small, nearly semi-circular in shape, though somewhat produced in front, rather abnormally convex transversely, slightly constricted at hinder margin, stretching far down laterally and with no sign of a dorsal depression—another abnormality. *Surface* inclined to be greasy-looking, the segmental margins nowhere well defined; a central dorsolateral depression on segments 4- 9, the segments sightly shallowly corrugated on sides, a depressed line above each spiracle and a dorsal, transverse depression on segments 3, 4; the whole body covered with minute, round, white tubercles; the margins of segments 2 and 14 very sparsely and shortly haired; the gland on segment, 11 large, transverse, mouth-shaped; the organs on segments 12 small, circular, white, inconspicuous. *Spiracles* small, flush, round, white, situated on the very margin of the subspiracular, yellow (yellowish green in some specimens) band. *Colour* either dark rose or grass-green; when the latter, the subspiracular band is yellowish green, bordered above and below by a yellow line; this band about $\frac{1}{3}$rd the breadth of the body, the gland rust-pink as well as the surroundings for a short distance; when rose-coloured there is a broad, spiracular, yellow band and a lateral, narrow yellow band both curving towards the gland on segment 12 at the ends; and there is dark. dorsal line on segments 7-9; segment 2 has a dorsolateral, green. longitudinal mark or band on each side of dorsal line in continuation of the general body pattern; the markings or pattern of this larva recall those of *Arhopala centaurus* very much; the belly or ventrum is dark green. L: 15 mm.; B: 2·5 mm. at segment 2, 4 mm. at segment 10.

Pupa.—More or less normal in shape except as concerns the anal segment which is here dilated to resemble a horse's hoof though not very accentuatedly so—in which, as in the larva, this species resembles *Arhopala centaurus*;—with its surface absolutely at right angles to the longitudinal axis of the pupa instead of being turned under as in the majority—nearly all—lycænines; front margin of segment 2 square in front, slightly concave perhaps along margin—semi-circular in, outline on the whole—hiding the head from above; the *head* with frons fully exposed and not bent under, rather high; segment 2 very convex transversely, its dorsal slope in the same plane as that of the anterior part of thorax; this latter humped a little, transversely convex, its apex being the highest part of the body (or, perhaps it is segment 7, for there is very little difference, if any), the apex slightly depressed, the dorsal line obscurely thin-carinate, its hinder margin produced rather far back in dorsal line, very nearly triangularly, leaving the segment 4 more than usually exposed and long, especially laterally because of the broad, rounded, deep angle at which it meets the wing lines; constriction behind thorax very slight, the dorsal outline of abdomen only slightly convex, the ventral line of pupa straight. *Surface* pupa is slightly shining and covered all over with minute, erect hairs and glabrous, flat tubercles; a small, depression laterally in centre of each abdominal segment; the gland-scar is linear, large, transverse. The *spiracles* of segment 2 are very narrow, slightly raised, rather long and whitish in colour—not very conspicuous : the rest roundly oval, flush, white. rather conspicuous. *Colour* varies from blackish pink to green with the thorax varying from pinkish green to green ; on the posterior slope of the thorax, dorsally is a very conspicuous diamond-shaped mark extending from the apex to the hinder margin, light brown in colour with a broad, brown border ; a dark dorsal, longitudinal line on abdomen, a lateral row of black spots, one to each little lateral depression and some small black dots—generally 3—immediately below each spiracle. In one green pupa the diamond on the thorax was rustly pinkish with a yellow dorsal line from its apex to anterior margin of thorax ; another one was green with a darker green, abdominal, dorsal line ; the green of abdomen rather yellowish in hue ; wings light ; ventrum pale ; lateral abdominal depression sometimes touched with black, sometimes not ; shoulder-points, ditto. L : 15 mm B : 4 mm.

Another larva was rather dark, bright yellow-green with a dark green dorsal line from segment 3 to segment 14, flanked by a violet tinged, broad band which, in its turn, was flanked by a dark green, broad, lateral line ; round the gland : reddish purple.

Habits :—The eggs are laid, generally singly, on the undersides of the fresh young leaves of the foodplant *Saraca indica* or Ashok; these young leaves hang down limply from the young branches and twigs and are often stuck together by their fresh, moist surfaces, delicate pink in colour, deeper on the underside than on the upper, and are nearly always the resort of red ants *Œcophylla smaragdina*, which invariably attend the larvæ. These latter live on the undersides of the leaves, often half a dozen of different ages together and eat the substance irregularly in holes and patches; they exude a copious juice from their large glands and the ants lap it up with considerable energy and celerity. They are sluggish larvæ and stick tight to their leaves even when touched, trusting, possibly, in their immunity from ordinary enemies which they enjoy through the presence of their defenders, the ants. Red ants *en masse* are never pleasant customers to tackle.

The above foodplant, a well-known small tree where it occurs, is confined to cool jungles and evergreens, being very plentiful along water courses in the hilly parts of the Western Ghats in Kanara and elsewhere. It is a striking object when in bloom as the flowers are arrayed all along the branches—sometimes even on the stems—in dense, orange, yellow and red clusters and are at times so numerous, as to produce an absolute blaze of colour against the background of dark green leaves and sombre grey stems which form their usual setting. Place numbers of these trees along the banks of a silver-rippling stream under a dense overhead canopy of giant stems in a deep ravine with the clear water sparkling and playing over a shallow bed of pebbles and many coloured gravels to an insistent music of gentle gurgles and lonely little splashing noises amidst a mysterious surrounding of dark corners and dead silence and—there is the home of this butterfly. Such, at least, was the place where the first caterpillars were found. Such is the best hunting ground, surely; the best place to find them at all times, and to catch the butterflies. However, Ashok is not the only foodplant. It is probable, as happens with most lycænids the larvæ of which are always attended by ants, that the main attraction or requisite is the presence of these protectors. Caterpillars have been thus found on *Combretum extensum* and *Terminalia paniculata*; both belonging to the family *Combretaceæ*. *Saraca* is a genus of *Leguminoseæ*. The butterfly is a fairly strong flier but keeps more or less to the lower vegetation and small trees in the jungles. It does not fly far at one time and rests with it wings closed over the back. It has been recorded from Sikkim; Bengal; Orissa; Kanara on the Western Ghats in Bombay; Assam; Burma; Tenasserim; the Andamans; extending into the Malayan Sub-region as far as New Guinea.

10. Genus—EVERES.

This is a group of five distinct species covering the whole world except South America and the Pacific Islands. In India there are three recognised species of which only *Everes argiades* concerns us here. This particular butterfly is found in North America, all through Central and Southern Europe except in Britain and Spain; practically throughout Asia except in the extreme north; throughout the Malayan Sub-region to Australia and, in the limits of British India, throughout India; Ceylon; Assam; Burma; Tenasserim; the Nicobars.

147. Everes argiades, Pallas. A very variable form especially in the colouring on the upperside in the female. Male. *Upperside*: violet of lighter or darker shade. Fore wing: a terminal edging of brown of varying width and an obscure, anticiliary, black line; costa generally with a very narrow line of brown: cilia brown at base, white outwardly. Hind wing: costal margin more or less broadly brown, this brown edging continued in some specimens down the termen to the tornal angle, in others only for a short distance or not at all; subterminal, black spots in the posterior three or four interspaces, the one in interspace 2 largest, the two in interspace 1 minute, sometimes geminate; generally the spots are outwardly edged very narrowly with white; finally an anticiliary slender black line much more prominent than on the fore wing; tail black tipped with white. *Underside*: white to brownish-grey, the markings sometimes prominent, very often pale and faint, those constituting the discal bands on both fore and hind wings round and black, or transverse, linear and pale brownish. Fore wing: a short transverse line on the discocellulars: a transverse discal row of spots followed by an inner and an outer subterminal maculate band which may be slender and well marked or with the inner band broad and each spot composing it diffuse; finally, an anticiliary, very slender, black line. Hindwing: a transverse, subbasal series of two, sometimes three, black spots; a slender, short, brownish line on the discocellulars; a transverse, discal, bisinuate series of black spots followed by a somewhat obscure, postdiscal, transverse series of black or pale brownish lunules, a subterminal series of black spots and a slender. anticiliary, black line; the subterminal portions of interspaces 2 and 3, sometimes of 4 and 5 also, that lie between postdiscal series of lunules and the outer edge of the subterminal row of spots ochraceous yellow, the spots themselves in interspaces 2 and 3 much larger than the others. Antennæ black, the shafts speckled as usual with white; head, thorax and abdomen brown, with a pale purplish flush on the thorax and abdomen in fresh specimens; beneath: palpi, thorax and abdomen white or grey. Female. *Upperside*: in the commonest form dark greyish-blue. Fore wing: the costa, apex and termen very broadly fuscous-black, with an obscure, black, anticiliary line as in the male. Hind wing: as in the male but the costal dusky brownish-black edging much broader, always more or less continued along the termen; the subterminal rows of spots often nearly complete to apex, those in interspaces 2 and 3 very large and crowned inwardly with ochraceous yellow, in some specimens more or less obsolescent. Specimens of the female with the ground-colour on the upperside entirely brown and the terminal markings on the hind wing indistinct are not uncommon. *Underside*: as in the male, the markings on the whole more distinct. Antennæ, head, thorax and abdomen as in the male, but without the purplish flush seen on some specimens of the latter. Expanse; male and female, 23-30 mm.

Egg.—Circular in *shape*, depressed; the upper surface very slightly sunken, almost flat; twice as broad as high. *Surface* covered with reticulations, forming little cells of various shapes with an irregular net-work-pattern of triangles and squares with irregular sides; the intersections of the lines forming the cells are thickened in various degrees and prominent, some more prominent than others; on the depressed part of the top or crown the reticulations are without knobs at the intersections; the knobs on the sides diminish in height towards the base; the central micropyle is darker than the rest of the egg and is more or less smooth and irregular in contour on the whole; surface is slightly shining; the bottoms of the cells finely granular. *Colour* clear greenish-blue with the reticulations and knobs white. B : O. 5 mm.; H : O. 25 mm.

Larva.—In the first stage is like all other lycænid larvæ in *shape*. *Head* shining, greenish-olive with black mandibles and eyes; round in shape. *Surface* dull, sprinkled with minute, black points; the dorsum is depressed down the dorsal line and, on each side of it on each segment are two subdorsal long, white, serrated hairs curving backwards, the anterior one the longer; laterally are two spiracle-like discs outlined with dark olive: below these again, supraspiracular, are two minute tubercles, each bearing a club-shaped hair except on segments 6, 7, 8 which have hairs only on the posterior tubercle; a subspiracular row of three long, dark-based hairs projecting laterally on each segment; some similar serrated hairs on the lateral, ventral surface and shorter ones on the pseudo-legs. The sides of the body are sloping from the dorsal hairs to the dorsoventral margin. *Colour* pale ochraceous in shade, pale grey in bright light; whitish to the naked eye. L : O. 75 mm. finally 2 mm. before the first moult. In the second stage the body is considerably humped dorsally in segments 3 to 10, segments 2, 11, 12, 13 being rather depressed with a decided lateral ridge. *Head* shining black, set with a few fine, whitish hairs. *Surface* is finely granulated and studded all over with serrated hairs of various lengths, the subdorsal and lateral ones longest and curved; the former dusky, the latter whitish, all with bulbous bases from which rise thorn-like, minute spines so that each base forms a star-like body; numerous discs, besides, scattered over the body. *Colour* pale yellow with a dorsal, longitudinal, brownish stripe; a diagonal, lateral, brownish stripe to each segment and a sub-spiracular, rust-coloured line, bordered above with whitish. Other forms occur: pale greenish with slightly darker markings. L : 2 mm.

After this, the shape is very similar to the last, but on segment 11 there is a rudimentary gland surrounded by minute, star-like processes and a fringe of delicate white spines and bristles, each bearing a tuft of extremely fine spine-like hairs. Both forms of colouring now more or less approach each other. L : 5 mm.

After the third moult in the fourth stage that is—the *surface* is thickly sprinkled with serrated hairs of different lengths, the subdorsal ones the longest, all with swollen, star-like bases varying in form and colour : some are brownish, others shining whitish resembling little glass petals ; numerous discs scattered all over the body. *Spiracles* prominent, round, outlined with brown. *Colour* a beautiful, clear green with a darker green, longitudinal, dorsal line, three longitudinal rows of diagonal, green, lateral markings and a waved, dull-green, lateral band bordered below by a pale line ; and faint dull brownish-pink streaks. The gland on segment 11 is now more distinct and surrounded with similar processes and bristles. L : 6·25 mm.

Fourth moult or fifth stage. The *shape* is of the usual onisciform type with slightly flattened sides and a very shallow, dorsal furrow. *Head* round, black, shining, hidden under segment 2 except when protruded. *Surface* densely studded with short, spine-like, serrated bristles which vary much in length and colour, from white to pale brown ; a subdorsal row of longer spine-like, slightly serrated bristles or hairs ; of varying length ; all these hairs or bristles with wonderfully formed bases (similar but more pronounced than in the previous stages), composed of a bull-centred star, the points rising from the base : some are wholly white, others, olive-green ; also numerous shining whitish-green discs outlined or set in more or less starred black rings of various sizes scattered all over the body ; the gland of segment 11 is similar to that in the previous stage, being a small, elongated, transverse fissure, fringed with fine, white bristles as described ; on segment 12 are the usual, dorsolateral organs, circular in opening, from which are protruded on occasion, one from each, little white cylinders. *Spiracles* round, whitish, small, bordered brown. *Colour* pale green with a darker, dorsal stripe or line ; fainter green, diagonal, lateral lines. L : nearly 10 mm. ; B : 3 mm.

Pupa.—Normal in *shape* ; the *head* truncated in front, the thorax slightly humped ; the dorsal line of abdomen rising from segment 5 to 7 and then falling away in a gentle curve to extremity which is bluntly rounded. *Surface* minutely reticulated ; sprinkled all over except on the wings with slightly curved, moderately long, white, serrated hairs, each with a minute, swollen base ; near the insertions of the wings are a few fine, white erect hairs, the points branched. *Spiracles* small, oval, whitish, slightly raised. *Colour* pale green ; the wings rather lighter with still whiter veins, irregularly sprinkled with minute, black specks ; a dorsal line composed of a series of black marks and specks forming a well-defined line over the head and thorax, broken up into a series of spots on a darker ground-stripe on the abdomen ; a supraspiracular series of small, black dots, one on each segment 4-7 and a large, somewhat oval, black blotch on segment 5 ; two others : one at the base of the wing on thorax, another on segment 4, also a small spot on segment 2 ; all and a few other tiny specks sprinkled all over the body are black. L : 9 mm. ; B : 3 mm., of fairly uniform breadth all through.

Habits :—This butterfly *Everes argiades* is called the Short-tailed Blue at home in England and has not, as far as is known, ever been bred in India. All the foregoing life-history is taken direct from F. W. Frohawk's description in *The Entomologist* of October 1904, volume xxxvii, No. 497. He says of the eggs "undoubtedly in the wild state, they are laid singly .... on account of the cannibal habits of the larvæ". In the process of rearing the larvæ he further remarks: "All the eggs hatched on July 30th, remaining six days in the egg state, the larva makes its exit by eating the crown as well as a portion of the side of the egg-shell. Directly after emergence it is exceedingly small. It is very active when first hatched, crawling rapidly for such a small creature and feeds on various parts of the plant (*Lotus corniculatus*). I found one feeding with its anterior half buried in the end of a stem which had been cut off. First moult August 3rd, the first stage only lasting four days. Shortly before the first moult it measures only 1·6 mm. long. During the early stages these larvæ, like other *Lycænidæ*, require the greatest attention to distinguish their changes, on account of their small size and similarity of stages, and unless most carefully watched under a lens it is practically impossible to detect their moults. Second moult, August 7th. In this stage it greedily feeds on the seeds of *Medicago lupulina*, eating through the capsule, and devouring the contents, but appear to feed mostly at nights. Third moult, August 12th. In this stage they feed as much by night as by day but are much slower between the moulting, occupying eleven days from the third to the fourth moults. Fourth and last moult, August 23rd. Although the gland is so similar to the gland of *Lycæna arion*, I have been unable to detect any liquid exuding from it when touched; also it appears less sensitive when touched. During the last stage I supplied the larvæ with both the common white and red clover-blossoms, which they greedily devoured. One larva completely ate up the whole of the petals of a red blossom in two days; it appeared to be feeding continually both day and night the whole time. It also feeds on the flowers, seeds and leaves of *Lotus corniculatus*. During their earlier stages the larvæ are decidedly cannibalistic. I noticed one after the first moult feeding on a newly-hatched larva, which it seized as it emerged from the egg; but during the last two stages I did not find them attacking each other, which agrees with the cannibalism of *L. arion* larvæ. The pupa is attached to the foodplant by the cremastral hooks to a pad of silk and a girdle round the body; all nine were attached to the centre of the leaves, and the general resemblance, both in form and colour, between a decaying *Lotus* leaf and the pupa is very great. The pupa remains in that state from about ten to fourteen days according to temperature. The first imago emerged on September 6th, the last on September 18th, 1904."

Scudder says that, in Europe, the larva feeds on "*Lotus*, *Anthyllis*, *Medicago*, *Trifolium*, *Pisum* and *Onobrychis*, and even on *Rhamnus*; in North America it feeds on *Lespedeza*, *Phaseolus*, *Desmodium*, *Galactia*, *Trifolium* and *Astragalus*."

De Nicèville states that *Everes argiades* occurs in the moister portions of Ladak in India, throughout Kashmir, all along the Himalayas, &c. He continues "I am surprised to find that it does not occur on the Western Ghats." In this he is wrong, for it does, as it has been taken in Kanara District of the Bombay Presidency; but it is very uncommon there.

11. Genus—Nacaduba.

This group contains a number of species which are all some shade of blue, violet or plumbeous-purple on the upperside in the males; the female has the upperside black with the base marked with iridescent blue or purple scales, sometimes largely pearl-white on the disc and base beneath the scales. The undersides are greyish or ochraceous-brown crossed by whitish lines in pairs or chain-like bands. The genus is chiefly Indian but two species extend to Australia. Fourteen occur in India limits, only two of which are mentioned here although there are several others which really occur in the hill-stations of the Western Ghats, but these cannot be called common: *viola*, *plumbeomicans*, *dana* and *macrophthalma*. The larvæ and pupæ of three species are known, the two described below and *plumbeomicans*; the larvæ are attended by ants. All are insects of moderately strong flight but never stay long on the wing; they go to flowers, but not very much; they are, however, often found sucking up moisture from the ground in the hot weather and some are especially found of fresh cattle-droppings: *dana* for example. All are species of scrub-jungle or real forest and only *ardates* is commonly found in the Plains. The peculiarity of the genus consists in that it contains both tailed and tailless species (*dana* from Kumaon to Sikkim; Bhutan; Bengal; Southern India; Nilgiris; Western Ghats in Bombay; Cochin; Chittagong; Burma; Tenasserim; and *hampsoni* from Mussoori and the Nilgiris), as well as one species (*ardates* from Peninsular India, avoiding the desert tracts, to Travancore; Ceylon; Assam; Burma; Tenasserim; Andamans and Nicobars; extending across the Malayan Sub-region to the Philippine Island) which is sometimes tailed, sometimes tailless. The transformations of *N. atrata* and *N. ardates* are given below. Those of *plumbeomicans* are given in addition.

148. Nacaduba ardates, Moore. Male.—*Upperside*: purplish-brown or purplish with a dark tint, some specimens brown with a very slight purplish sheen seen only in certain lights. Fore and hind wings: nearly uniform, both with slender black anticiliary lines, the hind wing in addition with the costal and dorsal margins paler: in most specimens with a subterminal black spot in interspace 2, sometimes seen only by transparency from underside; tail black tipped with white. *Underside*: brown, hoary, brownish or pale dull brown. Fore wing: a subbasal pair of transverse white strigæ, a shorter pair along the discocellulars and a discal pair; these strigæ all narrowly edged on the inner sides of each pair with fuscous which gives the appearance of transverse bands somewhat darker than the ground-colour; the subbasal pair extend from vein 1 to vein 12, beyond the discocellular pair from upper to lower apex of cell and the discal pair are very irregular and dislocated at each vein, the whole having the appearance of a dark sinuous band; terminal markings often very faint and ill-defined or again fairly prominent and consisting of a double, subterminal series of transversely linear, sometimes, lunular, dark spots, with edgings paler than the ground-colour; lastly, an anticiliary dark line. Hind wing: with transverse pairs of white, inwardly fuscous-edged strigæ similar to those on the fore wing, but even more irregular and broken; the subbasal pair extend from costa to vein 1. below which the dorsal area is whitish; the discocellular pair extend from the costa and posteriorly coalesce with the discal pair which are as irregular and dislocated as in the fore wing; terminal markings similar to those on the fore wing; but the double subterminal series of dark spots more lunular and a prominent round black subterminal spot crowned with ochraceous in interspace 2. Antennæ, head, thorax and abdomen dark brown; the shafts of the antennæ speckled with white; beneath: the palpi fringed with black, thorax dark greyish-brown, abdomen white. Female. *Upperside*: brownish purple, sometimes fuscous. Fore and hind wings: as in the male with anticillary dark lines, but differ as follows:—fore wing: an iridescent bluish sheen from base outwards to disc; hind wing: a slender more or less prominent white line edging the anticiliary black line on the inner side, a subterminal geminate double black spot in interspace 1 and a similar larger single spot in interspace 2. *Underside*: ground-colour paler and brighter than in the male, the markings similar but more neatly and generally more clearly defined; both fore and hind wings in most of the specimens that I have seen with a white terminal line before the anticiliary dark line. Antennæ, head, thorax and abdomen much as in the male. Expanse: male and female, 20-25 mm.

This is a variable insect both in the shade of the ground-colour and in exact shape and disposition of the markings as is pointed out by Colonel Bingham. He says "In females from the Andamans, the ground-colour on the underside of the wings seems always to be a rich, golden ochraceous. I have also seen specimens of the female from Continental India, Assam and Burma, with the ground-colour of the same shade. The markings on the undersides of these specimens are always narrower, neater, more clearly defined; and the pairs of white lines, instead of being edged on the inner sides of each pair by fuscous are margined by black lines. Also certain specimens from Sikkim, from Ceylon and from the Andamans resemble very closely, both in ground-colour and in markings of the underside, the figure of *N. nora*, Felder, on plate xxxiv, fig. 34 of the 'Novora Reise' volume on the Lepidoptera. I believe Felder's species is simply a variety of *N. ardates*." As for the form *N. noreia*, Moore, de Nicèville says: "Of all these, the only one that presents any difficulty in identification is *N. noreia*. That species has no tail, and I have always considered it to be a dimorphic form in both sexes of *N. ardates*, Moore." From breeding in Kanara, Bombay, the "rich golden ochraceous" colour of the underside seem to be due to heavy rainfall and is always confined to the female.

Egg.—Turban-*shaped*. The *surface* covered all over with reticulations forming cells, the walls moderately broad and high, especially just at the change between the flat, somewhat depressed top surface to the perpendicular sides where the intersections are thickened and prominently raised into little round-topped prominences which are erect, slightly flattened above and below and shining; these prominences lose themselves towards the base as well as very soon after they get over the rim on to the flat top; the highest prominences are quite the height of one cell diameter where they are; the largest cell is just over the rim on the side of which it takes up, indeed, most of the height—the cells in this particular row are all hexagonal and from each knob or intersection-prominence radiate 6 thin rays to the intersections surrounding it; all the other cells are, nearly without exception, more quadrangular and decrease in size from the brim to the centre of the top, but not rapidly, those around the central, irregular, low-walled surface containing the micropyle being 7 or 8 in number and somewhat distorted, the smallest of all; the rows of cells are arranged more or less—this is not quite regular—either in wide sweeping curves, all having their origin at the micropyle theoretically and curving out like the picture of a catharine-wheel firework; the bottoms of all the cells are finely granulated and that of the micropyle-surface is pitted; the whole surface is shining like glass in a strong side-light. The *colour* is very light bluish-greenish to the eye; under the lens all the walls and prominences are white and the bottoms of the cells greenish. B: O. 4 mm.; H: O. 2 mm.

Larva.—Is of the type of *Lampides bœticus*; in shape very like that of *Nacaduba atrata*; head light, translucent yellow, eyes black; hidden under segment 2, round; body the same breadth from segment 4 to segment 10, and, if anything, getting broader towards the latter segment: broadest about middle or segment 10, highest in middle—nearly the same height from segment 3 to segment 10; segment 2 is more or less semicircular in outline, convex transversely and tumided, with a deep, central, dorsal 4-sided depression at each lateral angle of which is a single hair and the bottom of which is clothed with minute, sparse, erect, star-hairs and the segment has a depressed, lateral point just above the spiracle and a further longer depression in front of it; the anal segments—11 to 14—are, together, nearly indistinguishable one from the other, have their dorsal line sloping gently to end, are more or less flat on top and the surface pitted dented all over, the extreme end of segment is broad and round; segment 11 suddenly lower than 10, the latter somewhat tumid at hinder margin; segment 11 has the hinder margin curved convexly forwards slightly; segment 12 has the hinder margin very strongly curved forward. The *surface* of the larva is clothed densely (about a star-diameter apart) with short stemmed, shining, whitish yellow stars and dark red, star-based, slightly curved, feathered bristles, all very small, producing, by their colour, the pattern of lines and patches; the margin of body and bases of legs clothed with longer, fine, light hairs from simple, conical—tubercular bases, those at the ends somewhat fulvous. The star-tops are not as wide as a spiracle, the bristle from them about 5 × their length, the simple-based marginal hairs 3 × these and still very short; segments 3, 4 dorsally dented a good deal, giving the appearance of flat tops to those segments; segments 3-10 with a lateral dent just above spiracles, the dent being long and transverse (to body); all segments well distinguished from each other, the hinder margin of each one being higher than the front margin of the succeeding one; gland rather large, mouth-shaped; organs of segment 12 with the circular openings white. *Spiracles* round, rather small, flush, white, the protrusible white cylinder with feather—hair bristles thinly dark-rimmed. *Colour* of larva dark or light green with an interrupted, broad, dark red or greenish, dorsal line on segments 5-10; this line flanked by a more or less bright yellow (or whitish) line on each segment, which gets broader towards the hinder margin and runs out laterally along the hinder margin; a broad, subspiracular, dirty, pinkish band, bordered sometimes by a more or less bright cream yellow interrupted band below; a dark, red spot near the hinder, lower margin of each segment; segments 11-14 dirty pinkish; segment 2 dirty green. L: 9 mm.; B: 2·75 mm=a little more than greatest height.

Pupa.—The *shape* is quite normal and like the other *Nacaduba* pupæ. It is square in front, rounded behind where the anal segment is turned under, the head being a good deal broader than the anal end; highest at the thoracic apex, visibly higher than at segment 6; broadest at segment 8 where the wings are somewhat roundly prominent seen from above and they are prominent back to the shoulders; the shoulders are also rather prominent; the thorax is very convex, large and rounded; the ventral line is ever so slightly concave; segment 2 has a straight front margin, the hind-margin is slightly waved forwards dorsally, the dorsal line is slightly under 45° to the longitudinal axis, it is a long segment, equalling in that respect segment 7; the thorax is large, the front slope at 45° or even slightly more to the longitudinal axis, the apex behind the line joining the shoulders, the posterior slope also considerable to segment 5, the hinder margin somewhat broadly, triangularly produced backwards with the apex rounded, meeting the wings in a very deep, broadly rounded angle of rather less than 30°; segment 4 is quite long, segment 5 rather short as is the manner of pupæ of the genus; segment 6 onwards nearly twice the length; the antennæ reach the end of the wings and broaden out there; the proboscis reaching the middle of the wing-length. *Head* large, the vertex showing in a thin line beyond the front margin of segment 2, the rest of the vertex is high, square and in a plane perpendicular to the longitudinal axis, the frons is ventral. *Surface* of pupa minutely reticulate, rugose; the thorax also widely, transversely shallow-corrugated, segment 2 coarsely pitted; covered sparsely with minute, translucent, white, erect, blunt-topped hairs, especially plentiful at both ends and in the intraspiracular region of the abdomen; some hairs just in front of the spiracles of segment 2 are plumed; otherwise the surface is shining. *Spiracles* of segment 2 linear, raised, pinkish-white; others very small, oval light in colour. *Colour* light pinkish-brown except on wings where it is yellowish-livid; a blotched, plentiful dorsal and supraspiracular band of black, the dorsum of segment 2, a patch above each shoulder and another laterally on segments 4 and 5 all black; speckled with black dots besides. L: 6·25 mm.; B: 2·5 mm.

Habits:—The eggs are laid on the little flower-heads before they are open, the butterfly walking all over them gingerly while looking for a safe place for each one. Each is deposited near the base of a bud, well concealed from casual observation, the end of the abdomen being thrust well down between the heads. The larva at first, when very small, bores into the flower-heads, later on feeds, as far as been observed, exclusively on the flowers, lying curled round them. It is attended by small ants, but not continuously. It is very difficult to see owing to its patchy colouration which blends well with the interstices between the flowers and the colours of the stalk, &c. The pupa is formed amongst the flowers, or anywhere else, and is attached in the usual way by the tail and a body-band. The foodplant is *Acacia cæsia* or Shembi as it is called in the vernacular of the country. It is more than probable that it will also be found on *Acacia concinna*, the Shige of the Kanarese people and others, as well. Both these are scandent, climbing, large, excessively thorny plants that are common all over India in suitable situations. Their leaves are bipartite and the leaflets small and feathery looking as in all *Acaciæ*; the flowers are in little round heads, each composed of many florets, arranged in large panicles and are yellowish in colour with a pleasant odour. The butterfly is generally very plentiful where the foodplant occurs and is fond of the sun and open, warm places in the jungles—in fact the places where *Acacia cæsia* grows and flourishes. It spreads, sometimes, over high trees. The distribution of the species as given by Colonel Bingham is: Peninsular

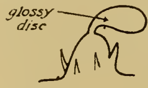
India from the outer Himalayas to Travancore, avoiding desert tracts; Ceylon; Assam; Burma; Tenasserim; the Andamans and Nicobars; extending into the Malayan Sub-region to the Philippines.

149. Nacaduba atrata, Horsfield.—Male (Pl. G., fig. 42). *Upperside*: pale dull violet with, in certain lights, a silvery sheen and the white lines of the underside showing through faintly; bases of wings suffused slightly with blue. Fore wing; a dark-brown line just before the *cilia* which are half brown like the line, the outer half dusky-grey with an occasional brown space; the extreme base with appressed, sparsely disposed, greyish, rather long hairs becoming more plentiful below vein 1; a long, white fringe of hairs along the inner margin merging in the *cilia* at the tornus. Hind wing: costa broadly somewhat paler, hinder margin brownish: appressed hairs at the base as on fore wing; in most specimens the subterminal, black spots of the under side showing through by transparency, in a few they are marked by actual scaling; an anticiliary, brown line as in fore wing, the *cilia* brown, less grey at the ends. *Underside*: brown with a pinkish shade; both wings crossed by transverse white lines, all about 1 mm. apart from each other, forming more or less perfect or broken bands by being arranged in pairs, the interval between each pair being sometimes darker than the rest of the wing-surface, occasionally lighter in colour. Fore wing: one subbasal pair running across the middle of the cell from the costa to vein 1, both waved, parallel; a medial pair from costa to the end of cell, one line on each side of the discocellular nervules and a single one continuing down to vein 1, starting from vein 3 where it joins the cell—generally seemingly from between the discocellular pair: a postmedial pair starting from vein 12 by the costa and reaching to vein 3, the inner line continued, but slightly dislocated inwards, to vein 1 and with a white short mark on the costa inside it, the continuation composed of two lunules in interspaces 2 and 1, both lunules convex outwards; a complete series of submarginal, inwardly slightly convex lunules and just inside the margin, followed by an inner and outer series of white lines; the last two closer together than the distance of the inner line from the submarginal, lunulate series; the colour of the wing between these last three lines darker forming series of brown quadrate marks between the veins, the inner double as broad as the outer; an anticiliary, narrow, brown line; the bases of the *cilia* brown, leaving the tips dusky-grey for rather less than half the length. Hind wing: the extreme base in the lower half of the cell and below as far as inner margin black sprinkled with a few blue scales; the following markings, starting from the outer margin: *cilia* brown, anticiliary line and outer and inner, inframarginal white lines as in the fore wing except that, here the inner is more lunulate with the convexity inwards, the inner lunule replaced in interspaces 2, 1 and 1b by jet black spots: that in 2 large, round, bordered inwards and posteriorly somewhat narrowly by a band of dull orange; and with a sprinkling of metallic green scales round the inner circumference except inwardly; in 1 by a much smaller spot, also bordered by orange and nearly covered with green, metallic-scales; in 1b by a still smaller, similarly ornamented spot without any orange border. Then follows a submarginal complete series of inwardly convex lunules nearly touching with their ends the inner series of the inframarginal ones as on the fore wing really except that in interspaces 7, 8 they are rather more internal; and then follow the following pairs of white, short lines, interspace by interspace, forming, sometimes short bands, but rarely, for two interspaces, never more: in interspaces 1a, one medial on the inner margin; interspace 1b, one postmedial, lunulate, outwardly convex; interspace 1, two of which one is more or less subbasal, the other postmedial: 2 and 3, one at base of each interspace; interspaces 4, 5 including cell: one subbasal, one medial (the discocellular band), one postmedial, bilunulate, outwardly convex, parallel; 6, one medial to the interspace; 7, one subbasal, one medial; none in 8. The subbasal pairs of lines form a subbasal band from vein 1 to vein 8, the middle portion of which, composed of the cell band, is displaced inwards so that the outer line is half way between the lines of the upper and lower parts or pairs. Antennæ black above, the club also altogether black with a white anteapical band and a greyish tip; palpi black: head, thorax and abdomen purplish-brown; beneath: antennæ black, thinly banded white reaching onto the sides; palpi white fringed with black; eyes rimmed with white, frons black; thorax bluish-white, longly haired; abdomen whitish. Female, (Pl. G, fig. 43a). *Upperside*: fore wing: costa, including half the cell and above vein 5 including the whole apex, and a terminal edging that occupies about one third of the wing, slightly narrowest in interspace 3, jet-black; the remainder of the wing white shaded at the base and along inner margin broadly with greyish-blue which, in certain lights, has a beautiful, opalescent, blue iridescence; the veins black outwardly; the base clothed with sparse, appressed, rather long, white hairs. Hind wing: the costa above the cell and vein 6 dusky-black; posterior portion of wing whitish-grey, the base shot with the same blue as on fore wing, with the veins blackish: a comparatively well-defined, transverse postmedial series of dusky blackish, inwardly-convex lunules edged inwardly and outwardly by thin, white lines; followed by a slightly narrower series of dusky-black spots edged outwardly again with white, the spot in interspace 2 generally more prominent; an anticiliary, fine, black line; the *cilia* light grey; tail at end of vein 2 thread-like, black, tipped with white. *Underside*: markings as in the male but the colour of ground grey tinted with brown, the transverse, white lines broader and more diffuse with the middle of the portions enclosed by these lines often lighter forming an obsolescent sort of medial line, the lines on the fore wing a little bit more irregular; an extra white, short line along the base of vein 7 (not really extra but, in the male, this is hardly noticeable); the inner series of oblong, inframarginal marks on the fore wing are nearly black in interspaces 1 and 2—or, at any rate, very dusky. Otherwise as in the male. Expanse: 30-32 mm.

Egg.—The egg is turban-*shaped*; the top only very slightly concave; the change from the top to the sides is gradual and rounded; indeed the top can only be said to be sunken near the middle where the micropyle is situated, the *surface* is shining and covered all over with high, but not particularly thick-walled, seemingly 4-sided cells with a little, round-topped, somewhat flattened knob or prominence at each intersection which becomes more or less obsolescent immediately around the central depression which is moderately large and surrounded by a few small cells in a couple of rows, the bottom of the depression minutely pitted; around these two rows of small cells the others rapidly get larger down to the sides and the rows are very diagonally arranged so that it is nearly impossible to say how many rows there are from top to base: there are about 8 or 9 cells from the central depression along a diagonal row and, perhaps 6 along a meridional line; there are about 24 cells in a complete circumference at the broadest part which is some way above the base; each intersection-knob is surrounded by six others and the shining top of each knob is connected by very thin, white ribs or lines which run down its sides and across the open so to speak, up to another knob; there are about ten such thin lines down each knob, *i.e.*, more than one to each surrounding knob. The colour of the egg is white, the thin lines connecting the knobs showing white against a darker colour; and all walls and knobs are more prominently white. B: O. 5 mm.; H: O. 25 mm.

Larva.—In *shape* of the usual onisciform (wood louse) type but the segments 3-10 are dorsally very tumidly prominent– as for that, also laterally along the dorsoventral margin they are well separated; segment 2 is more or less semicircular in shape, hiding the head in repose completely, but it is very much thickened, the dorsal portion being differentiated from a dorsoventral, tumid flange by a deeply impressed spiracular line (that is in the spiracular region) this dorsal part trapeze-shaped, somewhat depressed in the dorsal line with a diamond-shaped, flat-bottomed, rather small depression on the posterior, dorsal region up against the posterior margin; segment 3 is suddenly broader and higher than segment 2, and longitudinally very convex; segment 4 rather similar in shape except that the fall to the front margin is not so perpendicular as in 3 and it is also not so long as 3; segment 5 exactly like 4 and is the highest part of the larva, after which the dorsal line gradually slopes away to the anal end, segments 6-10 being like 5; segment 11 much lower and flatter dorsally than 10, the gland situated, mouth-shaped and transverse, on its hinder declivity; segment 12 also only very slightly convex longitudinally, nearly flat dorsally transversally, its hinder margin strongly curved forwards, the small round-mouthed, short, white, cylindrical, sparsely spine-topped protrusible organs in the usual position, the segment being perhaps slightly tumid where they are; segment 13 again lower than the hinder margin of 12, nearly quite flat, sloping at about 30° to the longitudinal axis of the larva and hardly differentiated at all from segment 14, these two together—if indeed segment 13 is the portion anterior to the end which is indicated by a transverse, rather indistinct furrow—forming the anal end of the larva which is shortly parabolic, slightly tumid and inclined to truncation; the lateral outline increases suddenly in breadth at segment 3 and very gradual to middle of body after which it gently decreases again to segment 12, then slightly more rapidly to the extremity; transversely the section of the body is a short parabola and the body is very prominently, tumidly flanged subspiracularly though the flange is not sudden or very pronounced in appearance: its ventral surface (of this flange) being in a horizontal plane, the body being suddenly narrowed below it so as to form a sort of pedestal for the dorsal visible part which is a usual formation in all lycænid caterpillars. *Head* shining, round small, light yellow with the labrum white, the broad, transverse, shallowly and widely emarginate ligula reddish-brown, the basal antennal joint white, the second reddish, the mandibles light, tipped brown, the eye curve filled in with black; the clypeus is large, triangular, more than half the height of the face, outlined slightly dusky. The *surface* of the body is extremely minutely shagreened-shining and covered all over densely with very minute, shining tubercular prominences which are generally higher than broad and are separated from each other by about their own height, sometimes by more; these prominences are irregularly and very minutely spined; there are also some little regular, star-like bodies, some very low and sessile so to speak, others very shortly stemmed—though the stems are not in the nature of stalks at all but are the same thickness all along—and they are either brown or green or nearly white; each one of these prominences has a little glass-like, shortly stemmed disc proceeding from the top and directed out at right angles to it—otherwise, parallel to the body-surface; in some cases this disc is hardly developed at all, forming what looks like a thick, glassy hair, sometimes it is quite undeveloped; There are a few very short, porrect, fine, whitish hairs on the dorsoventral margins of segments 2 and 14 and a few on the leg-bases but absolutely no others; each segment 3-9 has a small, dorsal, funnel-shaped, shallow depression and a lateral, lengthened one reaching from the dorsolateral region to the spiracle, the spiracles being situated in the bottoms of them. *Spiracles* small, round, whitish. *Colour* of the larva is bright and rather light grass-green with a dorsal (sometimes dull plum coloured), lateral and subspiracular, narrow, maroon-coloured band from segment 3 to anal extremity, even encroaching laterally round segment 2 at times; these maroon bands often more or less interrupted, sometimes obsolescent; belly darker green. L: 13 mm.; B: 4 mm.

In some cases the star shaped tubercles have a kind of small globule-like centre to them which looks as if the glassy hairs and discs are protrusible from inside and this is the more probable because of the fact that the hairs seem to be of variable breadths and shapes. The same has been noticed also in the larvæ of *Tarucus theophrastus* where the discs are more irregularly shaped and dentate along their front edge. An effort has been made in the margin to depict the shape and appearance of one of the spined prominences with a fully-formed disc.



Greatly enlarged star-shaped tubercle with its disc. (side view)

Pupa.—Normal in *shape*: very bluntly rounded in front, equally bluntly rounded behind where segment 12 is at a very steep angle to the longitudinal axis, segment 13 perpendicular to it, segment 14 turned under ventrally; the shoulders are broader than the front and slightly prominent; there is a very wide, shallow constriction reaching thence to the broadest part at segment 7; the thorax is evenly rounded, the highest part, the apex, being just behind the line joining the shoulders, the descent thence to segment 5 gentle, segment 4 being included in it, the hinder margin triangularly produced in the dorsal line though the apex of the triangle is narrowly rounded, this margin meeting the wings in a very deep, widely rounded angle of about 30°; the highest point of pupa is segment 6 though little higher than apex of thorax; segment 4 is rather large, segment 5 very short, the succeeding segments more than double its length, coequal. The antennæ reach to the end of wings, broadened at extremity; the probocis only half way; the legs fall far short of it; the palpi are broad. *Surface* shining, minutely, coarsely reticulate under the lens and, on the thorax, transversely shallow-corrugate; a few minute, plumose, short, erect hairs just in front of spiracles of segment 2; both ends: head, segment 2, segments 12-14 with some sparse, erect, transparent, blunt-topped, short, minute hairs; the other segments also but the hairs even shorter—not visible except under the lens; segments well-marked. *Spiracles* of segment 2 linear-oval, raised, slightly pitted, pinkish-white; the rest oval, conspicuously raised round the rims, slight in colour. *Colour* light pinkish, yellowish brown, the wings greenish with black marks: a dorsal, very macular line, a patch on each shoulder, another laterally on segment 5; a lateral spot on each abdominal segment; a sprinkling of dots and small spots all over, including the wings. L: 8·5 mm.; B: 4 mm.

Habits:—The egg is laid on the young leaves and, generally, on the underside. The larva lives free on the surface and eats from the edge, often pupating on the underside. Many larvæ are often found on one plant but the eggs are laid singly. The pupation takes place, really, anywhere, frequently even on the ground. The attachment is by the tail and a body-string. The larvæ are often ichneumoned or parasitised by small *Diptera*. The foodplant is *Embelia robusta*, one of the family *Myrsineæ*, a large climber with 2 or 3-inch long, longly-ovate leaves of a somewhat light, olivaceous green with prominent purple veins, common in the moist forests of the Western Ghat. Other foodplants are *Embelia ribes*, a small shrub with very similar leaves (but larger) and *Ardisia humilis*, both of the same family; the latter confined to the evergreen jungles where it often forms a gregarious undergrowth: it has large, thick, longly-ovate leaves, dark green on top, pale beneath, and little waxy, thick-petalled pink-red flowers. The butterfly is a fluttering, weak-winged insect, generally found in the jungles of the Western Ghat in Bombay where the rainfall is heavy. It never flies very far and is mostly to be found where its foodplant exists. It visits flowers in a desultory way and may sometimes be seen on the ground sucking moisture from damp earth or sand. It sits in the usual way with the wings closed and rarely basks. Its haunts are chiefly close to the ground in moderately shady jungle. Its distribution is: Sikkim; Bhutan; Southern India; the Nilgiri and Shevaroy Hills; the Western Ghats in the Kanara and Belgaum Districts of Bombay; Ceylon; Assam; Cachar; Burma; Tenasserim; the Nicobars; extending to the Malay Peninsula and Java.

The figures 43 and 43a on Plate G, on examination, seem to represent the male and female of *Nacaduba plumbeomicans* and not *atrata* which they were at first supposed to be. The two species are very similar on the uppersides but the figures are too dark and too pink; especially that of the female on the upperside of which the blue colouration is absurdly dark. It should be whitish with light blue scales at the base of the shade depicted on the figure of *Castalius rosimon*, No. 46 of the same Plate.

On second thoughts the figures above are, perhaps, after all, nearer to *atrata*. But, to avoid mistakes, a description of *plumbeomicans* follows here:—

149. Nacaduba plumbeomicans, Wood-Mason and de Nicéville.—Male. *Upperside*: dull purplish-blue, in certain lights with a shining, plumbeous frosting due to the wings being covered all over with small, appressed, white hairs (never present in *atrata*); the white markings of the underside never showing through. Otherwise exactly as in *N. atrata* except that, on the hind wing the bases of the *cilia* are inclined to be narrowly whitish *Underside*: purplish-brown—the colour is difficult to describe—with the white markings and black spots nearly exactly as in *atrata* but with the following differences:—Fore wing: the *cilia* dusky grey with a brown line through the middle: the terminal markings more blurred than in *atrata*; all markings narrower. Hind wing: nearly exactly the same except that the white markings are slightly finer; the black terminal spots in interspaces 2, 1, 1b are completely surrounded with dull-orange; the terminal markings more blurred and the *cilia* as on fore wing. Female. *Upperside*: fore wing; costa from the middle of cell and above vein 5, the apex broadly and a terminal edging that occupies about one-third of the wing black; the remainder of the wing white shaded with dusky-greyish which, in certain lights, has a beautiful, opalescent blue iridescence; on the inside of the terminal edging is a diffuse, dusky area defined inwardly by a line running from the edge of the black, at vein 4 to about middle of the inner margin which encloses near the black outer margin spots of whitish in interspaces 1, 2 and 3, one in each. Hind wing: costal margin above a line through the middle of the cell and above vein 6 dusky-black; posterior portion of the wing dusky-bluish, veins prominently black; a comparatively well-defined, transverse, postmedial series of dusky-black lunules edged inwardly and outwardly by similar series of finer lunules, all inwardly convex, followed by a subterminal series of dusky-black spots edged outwardly thinly with white; an anticiliary, black line; the spots decrease in size upwards, those in interspaces 2, 3 being most prominent and, occasionally, jet-black, those in interspaces 1 very small. Tail thread-like, black tipped with white. *Underside*: The same as male, perhaps slightly browner; the transverse, white lines broader, the bases of *cilia* whiter; otherwise as in the male. There is no appressed hair on the disc of the wings except at the base and below vein 1. There is often a dark line along the discocellular nervules of the hind wing. Palpi black above; eyes rimmed with white; frons blackish; antennæ black above, the club also black throughout with a white band near apex; thorax above black with brownish hairs in female, whitish in male; abdomen brown. Beneath: palpi with stiff mixed black and white hairs; antennæ finely banded white, reaching on to the sides; thorax brownish-yellow in the male and white in the female; abdomen whitish. The legs are striped longitudinally black and white (also in *atrata*). Expanse: 28-31 mm.

Colonel Bingham has described the female of this species as the female of *atrata* and, of course, the female of *atrata* as *plumbeomicans*. He gives the habitat as Tenasserim; Assam; Chittagong hill-tracts: the Andamans and Nicobars. To this is now added Kanara District in the Bombay Presidency.

The life-history of the species is as follows:—

Egg.—Turban-*shaped*; the top slightly depressed. *Surface* shining. covered all over with diagonal more or less parallel rows of small knobs with rounded tops, each knob connected with the surrounding ones by little, raised ridges or lines that meet in the interspaces at various angles and the interspaces formed by their meeting on the flat so to speak, are again covered with minute cross lines or ridges; without, however, any signs of thickening at the intersections of these minute lines; the knobs are very numerous, are somewhat variable in size, rather flattened on the top with a minute hollow in the centre of each flat top; they are separated from each other by their own breadth or four wall widths; they are largest at the rim and the outer circumference of the egg and down the sides, decreasing in size and prominence inwards to the micropyle which is, of course, central and of the size of, say, the interval between three of the largest knobs: the bottom shagreened-cellular; the rows of knobs radiate outwards in slowly diverging curves like a catherine-wheel firework going round and there are 16 such lines round the whole egg: from micropyle out to rim there are about 6 cells and three cells from base to rim—all these cells on the perpendicular sides are nearly perfectly quadrangular and the knobs are low and small, the really prominent one being situated at, and for a short space on each side of, the brim. *Colour* pure enamel-white—really honey-yellow but this colour is not always strikingly visible because of the multiplicity of white knobs and lines. B: O. 52 mm.; H: O. 25 mm.

Larva.—Normal in *shape*; flanged all along the dorsoventral margin; the highest point is about the middle of the body; the transverse section is somewhat triangular; segment 2 is semicircular in shape seen from above, rather thick, convex transversely with the dorsal central portion again thickened above a spiracular, linear, length-depression which does not reach the front margin, the central, dorsal depression not very large, diamond-shaped, deep, light bottomed; the anal segment flattened dorsally, sloping gently to extremity, broadly rounded at end, or even somewhat squarish. *Head*, completely hidden by segment 2, is small, round, shining, soiled yellowish-white; the clypeus is triangular, large, bordered by a soiled line; the mandibles brown-tipped; the eye-curve black inside. Segment 3 is abruptly higher than segment 2 and more or less overhangs the hinder margin of that segment with its middle, dorsal, prominent portion which is tumid between the dorsolateral lines; segment 4, in a similar manner, rises above the hinder margin of segment 3; segments 5-10 are all dorsally slightly convex longitudinally; segment 12 has the hinder margin curved strongly forwards in a simple, wide curve, the lateral portion on each side forming thus, more or less, a lobe upon which is situated the protrusible organ—the lateral portions of segment 12 are thus longer than the dorsal part—which has, as usual, a circular mouth; it is indistinct when in repose being the colour of the rest of the surface more or less, protruding white, cylindrical tubes with dilated, hair-set tops; segment 11 has the transverse mouth-shaped gland near its hinder margin. *Surface* minutely shagreened; besides, covered densely with translucent-white, star-tubercles as also with conical tubercles (these nearly all on the coloured parts to which they actually impart the colour) which are red in colour and about the same size as the stars, all bearing a short, longly-conical, colourless hair, the conical tubercle being generally slightly inclined and more or less simple, dark-coloured sometimes, while the longly conical hair is obconical and more or less erect; some comparatively long—still very short, however—hairs all round the dorsoventral margins; there may be a few slightly longer subdorsal hairs on segments 4 to 10; each segment 3-7 has a small, funnel-shaped, central, dorsal depresion as well as a long, linear, lateral one at the bottom of which and in it is situated the spiracle. *Spiracles* are small, round and raised, hollow inside, light in colour but not easy to see because in the depressions. *Colour* of the body is apple-green, sometimes faintly suffused with rose and, also only sometimes, with a dorsal and subspiracular (dorsoventral), diffused band with the margin of segment 2 green. L: 10 mm.: 4; B: 2 mm.; H: 3 mm.

Pupa.—Is normal in *shape*. The *head* just appears beyond the straight, never emarginate, front margin of segment 2: showing the vertex and the bases of the antennæ, the frons being flat, high and broad, perpendicular to the longitudinal axis of the pupa. Segment 2 is squarish in front, convex transversely with a gentle dorsal ascent to the thorax, the hinder margin waved somewhat strongly forwards in the dorsal region; the front slope of the thorax is at an angle of rather more than 120° to that of segment 2 and about 45° to the longitudinal axis of the pupa, the hinder slope very feeble, the hump not considerable or very convex, the slopes of the sides to the slightly prominent shoulders very steep, the hinder margin produced triangularly backwards, the apex of the triangle slightly rounded, the line of margin meeting the wings in a deep, broadly rounded angle of somewhere about 45°; the body is somewhat compressed laterally about segments 4-6 so that the wings are there somewhat roundly prominent; the body is broadest at segment 8 though little broader than at shoulders and the portion between is very slightly concave;

the greatest height is at the thoracic apex although only slightly higher than at segment 6; the anal end is rounded, as visible from above about the same breadth as the front of the pupa, segment 12 is steeply sloping, segment 14 slightly turned under ventrally at the extremity. *Surface* slightly shining, the segments well-marked if thin. very minutely reticulate-rugose and very thinly so; under the lens covered with minute, erect, blunt-topped, white-glassy hairs all over, specially dense on the margins (when looked at from above) and at both ends of the pupa, the hairs in front of the spiracles of segment 2 being, a few of them, plumose or feathered. *Spiracles* of segment 2 linear-oval in shape, rather prominently raised, white in colour; the others are oval in shape, raised, small and light-coloured. *Colour* of pupa is light yellowish-rose with a brown tint with a blotchy, dorsal, black line, a black shoulder-patch, another patch laterally on segment 5, a lateral dot above each abdominal spiracle; spotted besides all over, on wings and everywhere else, with black; the wings always lighter, yellowish or greenish. L: 8 mm.; B: 3 mm.; H: 3 mm. at thorax. A slighter pupa than that of *N. atrata.*

Habits:—That eggs are laid on the very young shoots and generally towards the axils of the leaf-stalks or on a leaf-bud. The larva lives between the folded leaves, often getting in between the two halves which are folded somewhat tightly together when very young; eats in round holes right through both half-leaf portions; afterwards, when grown, lives on the undersides of the tender leaves which it only eats. It is attended by ants but only fitfully. The pupation takes place generally in a well-sheltered place on the underside of a leaf, on an old withered leaf, &c., often near or on the ground; and the attachment is by the tail and a body-loop. The habits of the butterfly are those of *Nacaduba atrata* precisely in flight, resting position, localities, &c. The only difference is that this present species has chosen for the food of its larva the leguminous *Wagatea spicata* instead of the myrsinaceous *Embelia robusta*; both these plants are common on the Western Ghats in Bombay though the former seems to be more particularly fond of laterite soil. *Wagatea* is a more local climber than *Embelia*. Perhaps, on second thoughts the butterfly is a little stronger on the wing than *atrata* and is, seemingly, confined to the regions of heavy rainfall and jungle. It is quite plentiful on the coast in the Kanara District, Bombay, and in also found up to 2,500′ on the Ghats.

(To be continued.)

NOTES ON THE BIRDS OF AMBALA DISTT., PUNJAB.

BY

H. Whistler, M.B.O.U., F.Z.S.

Ambala City and Cantonments form the headquarters of a district of the same name, which is one of the most easterly in position of all the districts of the Punjab. It lies between 30° 2′ and 30° 13′ N. and 76° 19′ and 77° 36′ E., with an area of 1,851 square miles. It extends from the Sutlej river. which separates it from the district of Hoshiarpur to the north, to the Jumna river, which divides it from the district of Saharanpore in the United Provinces on the south-west. On the north-east it is bounded by the Submontane States of Nalagarh, Patiala Sirmur, and Khalsia; on the south by the district of Karnal; on the west by Patiala and the district of Ludhiana. The district is very irregular in shape, and consists of two almost separate portions. The main portion lies between the Ghaggar river and the Jumna river, comprising the three *tehsils* of Ambala, Naraingarh and Jagadri. This is formed of the plain which descends from the Siwalik Hills toward the south-west; it is fertile, generally speaking a good alluvial loam, but intersected by torrents, which pour down from the hills at intervals of a few miles; and it is interspersed with blocks of stiff clay soil, which in years of scanty rainfall are unproductive. In this part of the district lies the Morni hill tract which culminates in a height of 4,919 feet in the Karoh peak on the Sirmoor border.

The second portion of the district is the Rupar Sub-division, comprising the *tehsils* of Rupar and Kharar, which forms a submontane plain of great fertility, highly cultivated, and well wooded, with numerous mango groves, between the Ghaggar and the Sutlej rivers.

The district also includes the detached tracts containing the town of Kalka (2,400 feet), and the hill Cantonment of Kasauli* 6,300 feet.

As may be expected from the above description the district embraces ground suitable for several types of bird fauna. Unfortunately I was not in the district long enough to investigate their distribution and composition thoroughly, as I only spent some 6 months there, namely, the period from 23rd October 1915 to 20th April 1916. But I have here placed on record the results of my observations in order that they may perhaps afford a ground work for future Ornithologists who have time and opportunity to complete the survey of the district. Bird life is rich and varied, and of peculiar interest as comprising several distinct types of distribution. Kasauli is high enough to provide many of the typical Himalayan species; Kalka and the tracts about Chandighar afford opportunities of meeting submontane species; while the plains of the greater part of the district appear to be the meeting place of the typical Punjab and United Provinces faunas, with a most distinct bias towards that of the latter.

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* These particulars have been extracted from the Imperial Gazetteer of India, Provincial Series, Punjab, Vol. 1.

Ambala is the district of the Punjab about which there appears to be most on record in Ornithological literature, although what there is is scanty enough. Without being able to give a complete list of the men who collected there, I may note the more important records that I have come across.

First and foremost in importance come the notes made there by Captain R. C. Beavan, Bengal Staff Corps, who died at sea in 1870 at the early age of 29. These are incorporated in a general series of notes entitled "On Various Indian Birds" which appeared in the volumes of the "Ibis" for 1867, 1868 and 1869 and "Additional Notes on Various Indian Birds" in the "Ibis" for 1869 and 1870. A few short notes by him also appeared in the "Ibis" about the same time. These notes did not include the Raptores which appeared separately as "Sundry Notes on Indian Raptores", published in the "Proceedings of the Zoological Society for 1868."

Capt. Beavan appears to have been a friend and correspondent of Dr. David Scott, H.E.I.C.S., who was stationed at Ambala and died there about 1868. The latter collected a number of birds and mammals for the Montrose Museum, Scotland, and the majority of these specimens appear to have come from Ambala. In answer to my enquiry the Hon. Curator of the Museum very courteously informed me that the collection was still in existence in fair condition. He kindly gave me a copy of the catalogue printed in 1868, entitled "A list of Indian Birds, collected by the late Dr. D. Scott, H.E.I.C.S., and presented to the Montrose Natural History Society, 1867, corrected and revised by Lieut. R. C. Beavan, C.M.Z.S., Bengal Staff Corps." Species contained in this list, with the locality 'Ambala' are indicated by an asterisk placed after the serial number of my list.

I have found no published notes by Dr. Scott beyond a couple of notes on the habits of the Hoopoe at Ambala ("Ibis," 1866, p. 222 and 1867, p. 135).

Colonel Tytler appears to have resided or collected at Ambala, but I have not been able to trace many notes by him. The remains of his collection have, however, recently come to light and been presented to the Lahore Museum; when these skins are made available for study—they are at present in packing cases—I hope to ascertain more about Colonel Tytler's activities at Ambala.

There are a few specific references to the district in the four volumes of 'Birds' by Blanford and Oates in the Fauna of India Series, and in Oates' edition of "Nests and Eggs of Indian Birds". From time to time short notes on individual species have appeared in the Journal of the Bombay Natural History Society, in "Stray Feathers" and other publications. I have discovered and included a few odd notes from my father's old game books.

So far, however, as far as I know, no attempt at a collected account of the birds of the district has yet appeared. It is in order to provide the frame-work for such an account that I have prepared this list. In it I have included such published references as I have discovered under their respective species for the convenience of other observers: but working far from any complete library of Ornithological works I have doubtless omitted many published notes in volumes that are not included in my small private library. For the sake of uniformity the variant forms of the word 'Ambala' have all been corrected to the now official spelling. The nomenclature is for the most part that adopted by Blanford and Oates in the 'Fauna of India' volumes, and the serial numbers are those of the species in that work.

1.* The Raven—*Corvus corax*, L.

"Numbers of these birds may be found around Ambala in the cold weather; most of them disappear again, but some remain to breed. I found a nest....on 28th March 1866. It contained a nearly fledged young one." (Beavan).

Personally I found the Raven much scarcer at Ambala than at any other Punjab station where I have been posted. The only ones that I saw were a pair at Mubariqpur on the 3rd and 6th of November, a very few at Rupar in December, and a pair at Kalka at the end of December.

4.* The Jungle Crow—*Corvus macrorhynchus*, Wagl.

This crow appears to be widely spread in the district during the cold weather, occurring in company with *C. splendens*. In November, I found it common at Mubariqpur, Chandighar, and Bilaspur and at Chandighar again in February. In December numbers were collecting to roost in the bamboo jungle about Kalka, though in March they had gone leaving only a few individuals who would probably breed in the vicinity. On January 31st and February 4th, a flock was observed in Ambala itself, and a single bird came into my compound on February 10th. The species was abundant in Kasauli in the first week of March.

7.* The Indian House Crow—*Corvus splendens*, Vieill.

General distributed, abundant, and resident, mixing freely with the last species where it occurs. A few were noted as high as the bazaar in Kasauli during the second week in March.

Beavan records the large flights of these birds which assemble for roosting about Ambala, but states that they only occurred in the cold weather; at Jhelum, however, I noticed that the habit was continued also during the hot weather ("Ibis." 1916, p. 4.)

9. The Jackdaw—*Corvus monedula*, L.

Ambala is given as the eastern limit in the plains of this species (Fauna of B. I. Birds, Vol. I., p. 23.).

16. The Indian Tree Pie—*Dendrocitta rufa* (Scop.)

Common throughout the district, including the low hill jungles about Chandighar and Kalka. Beavan records it "about Ambala in 1866."

31.* The Indian Grey Tit—*Parus atriceps*, Horsf.

A winter visitor to the plains portion of the district, where I met with it commonly from November until the 1st March: it was perhaps most numerous in January and February. During the second week in March I found it common and generally distributed in Kasauli where it doubtless breeds.

99. The Himalayan Streaked Laughing Thrush—*Trochalopteron lineatum* (Vig.)

Found to be common on the upper parts of Kasauli Hill in the second week of March. One was seen in a nullah just above Kalka in the last week of December.

105.* The Common Babbler—*Argya caudata* (Dum.)

Although Beavan records this Babbler as abundant about Ambala I found it very much scarcer than in most of the Punjab districts, and indeed only met with a few individuals in the plains. There were a few in the cultivation below the Kasauli Road near Kalka in December.

107. The Large Grey Babbler—*Argya malcolmi* (Sykes.)

Met with fairly commonly throughout my stay in the vicinity of Ambala and in the country about Sirhind and Morinda. A nest with young was found at Ambala on the 16th of November.

Beavan says: "First procured in the neighbourhood of Ambala, October 1866, where it is not uncommon."

110. The Jungle Babbler—*Crateropus canorus* (L.)

"Abundant about Ambala." (Beavan). I found it common in the low hill jungle above Kalka during the last week of December.

116. The Slaty-headed Scimitar-Babbler—*Pomatorhinus schisticeps*, Hodgs.

On the 28th December I met with a pair in the bamboo and Euphorbia jungle just above Kalka: they were not particularly shy but kept in the thicker clumps of bamboo.

139.* The Yellow-eyed Babbler—*Pyctorhis sinensis* (Gm.)

Occurs in the catalogue of the Scott collection with the locality Ambala. I cannot remember meeting with the species myself.

187. The Himalayan Whistling Thrush—*Myiophoneus temminicki*, Vig.

This hill bird may be expected to occur throughout the low foot hills of the district in winter: during the last week in December I found many in a nullah just above Kalka and on visiting the same place on March 5th, I observed a couple of individuals. Two were seen by the Ghaggar at Chandighar on 12th February. It probably breeds at Kasauli as I saw several there in the second week of March.

226. The Indian White-eye—*Zosterops palpebrosa* (Temm.)

Met with commonly from the end of October until the end of March at Ambala, Rupar, Mubariqpur, Chandighar, and the low hill jungles about Kalka; in the last mentioned locality the species was very common in the first week of March, when the flocks had already paired off for breeding.

"It is seen also in gardens about Ambala" (Beavan).

269. The Himalayan Black Bulbul—*Hypsipetes psaroides*, Vig.

Parties were noted along the road between Kalka and Kasauli on 5th and 10th of March; two birds were seen just above Kalka on 28th December.

278. The Madras Red-vented Bulbul—*Molpastes hæmorrhous* (Gm.)

283. The Punjab Red-vented Bulbul—*Molpastes intermedius* (Hog.)

Common throughout the district, including the low hills about Kalka. Unfortunately I preserved no specimens, so am not sure which of the above races is the form represented in the district.

284.* The White-cheeked Bulbul—*Molpastes leucogenys* (Gray.)

Met with in numbers on Kasauli hill in the second week in March and in the low hills above Kalka at the end of December. Beavan records it as extremely abundant all along the road from Kalka upwards to Simla: he further adds "Dr. Scott writes to me lately that he has seen several specimens in the station at Ambala during the last hot weather. I never before had heard of its occurring in the plains." On Dr. Scott's list occurs the note "seen this year for the first time."

321.* The Chestnut-bellied Nuthatch—*Sitta castaneiventris*, Frankl.

Beavan states: "I made my first acquaintance with this handsome little bird when staying at Ambala with the late Dr. Scott (who had not previously observed it there, though Colonel Tytler had); and on the 22nd Oct. 1863 shot one in his garden . . . . two others procured in the same locality a few days later."

I found it common in the fine roadside trees of the Rupar sub-division from November till March, and also met with several at Ambala; on one occasion two entered my compound in a hunting party of various small insectivorous birds. I found a nest with young in a roadside Cirrhus tree in Civil Lines on 19th April. The ordinary call of this species is a shrill squeak very similar to that uttered by the common muskrat; the male has also a long tremulous whistling call. They are very fond of perching on twigs at the summit of high trees.

327. The Black Drongo—*Dicrurus ater* (Herm.)

Common and generally distributed, but their numbers seemed to be greatly increased during the second half of March by immigration. Beavan writes: "This species occurs also frequently about Ambala" and refers to a note on it there by Dr. Scott in the "Ibis" for 1867, at p. 136.

330. The White-bellied Drongo—*Dicrurus cærulescens* (L.)

Beavan says: "I have since procured the species at Ambala where it is rare. However, I procured an example in Dr. Scott's garden there, October 27th, 1866."

341.* The Himalayan Tree-Creeper—*Certhia himalayan*, Vig.

The first Tree-creeper was met with at Mubariqpur on 7th November; from the 9th to the 11th one was seen at Chandigar, and one was seen at Bilaspur on the 26th and 29th of the same month. It probably breeds in Kasauli as I met with one or two there during my stay in the station during the second week of March.

366. Blyth's Reed Warbler—*Acrocephalus dumatorum*, Blyth.

On April 1st one was heard singing lustily in a bramble bush in the jail garden.

374.* The Indian Tailor Bird—*Orthotomus sutorius* (Forst.)

Common, generally distributed, and resident. Found to be very abundant in the Bamboo jungles about Kalka both in December and in March.

377. The Moustached Sedge-Warbler—*Lusciniola melanopogon* (Temm.)

On 13th and 14th December I found this little warbler to be common in a thick patch of reeds near the Canal at Chamkaur. It was not particularly shy, especially in the mist of the very early morning, when it was perching on the tops of the reeds. But for the most part it crept about out of sight in the tangles of vegetation, from preference rather than shyness, as my near presence seemed to make no difference to it.

381. The Rufous Fantail Warbler—*Cisticola cursitans*, (Frankl.)

A few were noted about the marshes of Chamkaur in December, and of Mubariqpur in February.

382. Franklin's Wren-Warbler—*Franklinia gracilis* (Frankl.)

Found to be common in parties in the more open patches of cultivation by low bamboo jungle on the hill sides above Kalka in December; when I passed that way again in the first half of March the flocks seemed to have divided up into pairs, and the cocks were singing lustily, perched in conspicuous positions.

384. The Rufous-fronted Wren-Warbler—*Franklinia buchanani* (Blyth.)

" Some found about Lallroo " (Beavan.).

A flock was observed in grass jungle at Mubariqpur on 4th November and some more were seen at Kamalpur on 15th December.

389. The Striated Marsh Warbler—*Megalurus palustris*, Horsf.

This curious warbler was not uncommon in some dense reed beds near the Canal at Chamkaur when I was there on the 13th and 14th of December. It was not shy, but perched freely on the tops of reeds and flew across the open. It might easily be mistaken for *Argya earlii*, but that not more than two seem to go about together, whereas the latter bird is always found in flocks.†

399.* The Eastern Orphean Warbler—*Sylvia jerdoni* (Blyth.)

Beavan states: " I found it tolerably common at Ambala in October 1866, where it frequents the babool trees (*Acacia* sp.?), creeping about very silently, and, when disturbed, trying to sneak away into the thickest parts. Specimens procured on 22nd October had no trace whatever of a black head, and were considered by Col. Tytler to be the young of the year. But in my opinion the state of the plumage was not sufficiently juvenile; and I think that the old birds adopt a different colouring according to the time of the year, probably putting on the black head as the breeding season approaches.* [That this view of the case is correct, there is probably little doubt *cf.* Von der Muhle. Monoge. Eur. Sylv. p. 48. Editor. "Ibis"].

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† Under the heading of *Arundinax olivaceus* (= No. 393 *A. aëdon*) Beavan says: "Col. Tytler has referred some small warblers procured by me at Ambala, in October 1866, to this species, but my dimensions do not agree at all with Dr. Jerdons" : description follows. I have not been able to work out exactly what species this refers to.

The specimens just mentioned (A. and B.)....were moulting, the tail not being fully developed, but the white outer feathers beginning to show in it.

A specimen (C.), killed 27th October, was beginning to get a black head. It also was moulting, and was the first I had come across with any trace of the black plumage. Irides grey.

A fourth specimen (D.), killed on November 12th, had a fully developed black head, and its colour altogether of a brighter and purer hue than the specimens above-mentioned, one of which was a female ; but the sexes of the others were not ascertained."

402* The Indian Lesser Whitethroat—*Sylvia affinis* (Blyth.)

Beavan has the following note about this species :—

"A bird found very abundantly throughout the station of Ambala in the cold weather appears to be referable to this species. (Lord Walden, however, suspects it to be identical with the Common Whitethroat of England (*S. cinerea*), as Dr. Jerdon formerly it. See, however, Mr. Blyth's remarks on this point (Ibis, 1867. p. 28.) ......My specimens agree fairly in their measurements with the dimensions given by Dr. Jerdon, except in length, since none of mine exceed 5·5. It seems probable that Col. Tytler is mistaken in referring the Ambala bird to this species instead of to *S. curruca* with the description of which it agrees equally well."

I found this Whitethroat to be a most abundant and generally distributed winter visitor to all the plains portions of the district. It had already arrived when I reached Ambala on 23rd October and there were still many about when I left on the 20th of April.

The note is a slightly harsh chipping one, but about February the birds seemed to become rather silent until the end of March when I first heard the short but pleasant song. The species is usually solitary in habits but I came across a party, perhaps migrating, on 6th April. On 11th February I found two preparing to roost in a kikur bush ; they were sitting side by side close together in love bird fashion.

407. The Siberian Chiffchaff—*Phylloscopus tristis*, Blyth.

"Procured at Ambala, 23rd October 1866." (Beavan.)

Found to be common during November when I met with it at Jagadri and Bilaspur as well as at Ambala. After that I did not note it until 25th January after which date it was observed occasionally at Ambala, Rupar and Chandighar until 3rd April, than which I have no later record.

408. The Olivaceous Willow-Warbler—*Phylloscopus indicus* (Jerd.)'

First observed at Chandighar on 26th March when it was very common on migration. Here I made the following note on its habits :—" Seems to combine the habits of a willow wren and an accentor ; found commonly, often 2 or 3 together, in small bushes or wandering about on the ground at their bases, both about cultivation, or on the stony bush clad hill sides behind

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* Beavan's own specimens shew that this view is wrong : the colouration of the head is a question of sex and age.

Chandighar. In large trees it is fond of creeping about the wood of the larger boughs, especially on the main stems of horizontal ones, and is then very reminiscent of an accentor in its demeanour. When hunting about amongst foliage it is very lively and active. The call-note may be represented by the word "trick," and is more of the harsh chipping type of an *Acrocephalus* or *Hypolais* than Phylloscopine in character."

On my return to Ambala I found that it had also arrived there on migration and was not uncommon on the 30th and 31st March and during the first fortnight of April. One was seen on the 19th of the month.

416. Brooks' Willow-Warbler—*Phylloscopus subviridis* (Brooks.)

A female was shot at Chamkaur on 13th December in a tree on the canal bank.

418. Hume's Willow-Warbler—*Phylloscopus humei* (Brooks.)

This Willow-Warbler was by far the most common of the genus throughout the district and was observed during the winter from my arrival on 23rd October until the end of March, if not later. It frequents the upper branches of trees and the call—which may be represented by "teh-weet" or "te-we-ut" pronounced in one note—may be heard incessantly during the winter. About March the species seemed to become silent, and a nervous flitting of the wings probably heralded the approach of the breeding season.

Note—There are certainly some other species of willow-wren which visit the district as winter visitors or passage migrants and also one or two species are certain to breed on Kasauli hill, but I have not been there in the summer months.

434. Hodgson's Grey-headod Flycatcher Warbler—*Cryptolopha xanthoschista* (Hodgs.)

Met with not uncommonly at Chandighar, Jagadri and Bilaspur in November, at Morinda and Rupar in December, and at Mubariqpur in February. Observed at Kasauli in March.

458. The Brown Hill-Warbler—*Suya crinigera*, Hodgs.

During my visit to Kasauli early in March I observed a pair of these birds frequenting a more or less open hill side near the Dak bungalow. Here they had a nest ready for eggs in a Barberry thorn bush close to a path. The nest was large, about the size of a striped squirrel's "drey," and very firmly woven of various kinds of grass, green inside. The entrance was difficult to find, but the nest was quite unconcealed and depended for protection on its likeness to an old bundle of rubbish thrown into a bush.

464. The Ashy Wren-Warbler—*Prinia socialis* (Sykes.)

Common and probably resident; observed at Ambala, Morinda, Bilaspur, and Chandighar.

466* The Indian Wren-Warbler.—*Prinia inornata*, Sykes.

Common and probably resident; I did not however observe it elsewhere than Ambala except at Chandighar where it was found in the grass jungle of the Ghaggar river.

"Ambala, October 24th" (Beavan.).

469* The Indian Grey Shrike—*Lanius lahtora*, Sykes.

Met with in small numbers in the plains, except in the actual neighbourhood of Ambala, but not nearly so numerous as in the sandy plains of the more desert portions of the Punjab. Beavan however notes that "this species is particularly abundant about Ambala where I procured several fine examples about the station in October 1866."

I found a nest with 3 moderately incubated eggs on an island of the River Sutlej above the Rupar headworks on 21st March, and also procured 4 hard set eggs from a nest at Morinda on 31st March.

473. The Bay-backed Shrike—*Lanius vittatus*, Val.

"The most abundant and characteristic shrike near Ambala, and it apparently extends some little distance up the hills." (Beavan.)

Met with in small numbers and generally distributed throughout the winter until my departure on the 20th April.

476. The Rufous-backed Shrike—*Lanius erythronotus* (Vig.)

From November till the middle of April this shrike was found to be commonly distributed throughout the plains portion of the district. One was also seen in a nallah near Kalka on 29th December. Beavan states : "This species extends as far as Ambala, where I procured a fine specimen on the 26th October 1866."

479. The Pale-Brown Shrike—*Lanius isabellinus*, Ehr.

A single specimen was observed near Morinda on 12th December.

481* The Brown Shrike—*Lanius cristatus*, L.

Included in Dr. Scott's list with the remarks "very rare here."

148* The Common Woodshrike—*Tephrodornis pondicerianus* (Gmel.)

Common and generally distributed throughout the district, even extending a short way into the foothills above Kalka where I saw one on 10th March. They seemed to become more abundant in March, but perhaps this increase was more apparent than real and due to the birds being more noisy during courtship as the number noticed was normal again by the end of the month. Nests with eggs were found on 16th and 28th March. During the winter these woodshrikes often collect into parties and flocks.

Beavan's note on the species is as follows :—

"I have since observed this species at Ambala, and killed my first specimen there on 30th October 1866 in a garden. On the morning of November 9th, I procured 2 more from near the same spot; so that the species is evidently not uncommon there, although from its peculiarly quiet and silent habits it is likely to escape observation, and indeed had done so in the case of Dr Scott, who told me it was the first time that he had ever seen the bird."

495* The Short-billed Minivet—*Pericrocotus brevirostris* (Vig.)

"In the cold weather it apparently migrates to as far as Ambala, in the plains; for Dr. Scott told me that he had frequently procured specimens there, as I myself did, in his garden, in November 1866. From his notes it would seem that the species leaves the plains for the hills about the end of February or the beginning of March, breeds in the hills in June, and returns to the plains at the beginning of the cold weather, in September and October. Some examples, however, were seen by Dr. Scott on August 29th, 1866; but these were probably exceptional stragglers." So Beavan, who also notes obtaining a specimen at Ambala on January 18th, 1866.

For some reason but few of these Red Minivets visited the district while I was there; a few were noted at Mubariqpur and Chandighar in November; one, a female, was seen at Morinda on 8th December, and two at Kharar on the 20th of the same month.

500. The Small Minivet—*Pericrocotus peregrinus* (L.)

"It was the common species about Ambala, where I procured several examples, the first on the 30th October 1866; but they were much more plentiful after an interval of a few days, since I find that on the 3rd November I obtained three specimens, and on the 9th no less than six." (Beavan).

Abundant and generally distributed during the cold weather in parties which split up into pairs by the middle of March, though I met with a party still undivided in the last week of the month. They breed in March and April.

501* The White-bellied Minivet—*Pericrocotus erythropygius* (Jerd.)

Recorded from Ambala in the Fauna of B. I. birds, Vol. I, p. 488.

510* The Large Cuckoo-Shrike—*Graucalus macii*, Less.

Included in Dr. Scott's list as obtained at Ambala.

518. The Indian Oriole—*Oriolus kundoo*, Sykes.

A summer visitor only; it was first observed on 7th April and several more were met with before my departure on the 20th of the month.

528. The Rose-coloured Starling—*Pastor roseus* (L.)

A party of 4 were seen on 29th October and some more on 1st November. A flock were seen on 15th January; a party of 3 was observed at Morinda on 19th March. During the first half of April several flocks were observed on different dates, usually hurrying northwards.

529-534. Starlings—All races of *Sturnus vulgaris.*

Beavan says: "*Sturnus vulgaris** abundant at Ambala in January 1866."

I found Starlings to be abundant and widely distributed in November and December, and less common in January and February. During March I only saw a flock on the 1st at Ambala, a flock at Rupar on 23rd, and several flocks at Kharar on the 24th. Of these birds the majority were doubtless *Sturnus vulgaris poltaratskyi* (Hartert. Vog. Pal. Fauna = S. menzbieri. F.B.I. No. 532.), which is the common bird of the Punjab. But three individuals shot from 2 enormous flocks at Chamkaur on 14th December proved to be *Sturnus* v. *porphyronotus.*

538*. The Grey-headed Mynah—*Sturnia malabarica* (Gm.)

This species occurs in Dr. Scott's list of birds presented to the Montrose Museum with the following note "Ambala: very rare here,—this being the only one I ever saw. *I, however, procured it there on the 30th October 1866.—R. C. B.*"

544 The Black-headed Mynah—*Temenuchus pagodarum* (Gm.)

Not uncommon and usually observed in pairs during March and April; in addition to these I saw a flock and a pair near

Bassi on December 11th, and a pair near Lalru on February 14th: Beavan notes that it is rare at Umballa.

549*. The Common Mynah—*Acridotheres tristis* (L.)

Abundant, resident, and generally distributed it was found to be common in Kasauli in March.

551. The Bank Mynah—*Acridotheres ginginianus* (Lath.)

"Abundant at Ambala in November 1866" (Beavan).

Observed commonly throughout the plains portions of the district, from the beginning of November till the end of March.

552. The Jungle Mynah—*Æthiopsar fuscus* (Wag.)

A few were observed at Chandighar on 11th November and 13th December. There were many about at Morinda on 18th March.

555*. The Pied Mynah—*Sturnopastor contra* (L.)

"Still more so [*i. e.*, rare] at Umballa" Beavan.

561*. The European Red-breasted Flycatcher—*Siphia parva* (Bechst.)

This flycatcher was seen throughout the winter in small numbers, but it is noteworthy that only two red-breasted males were seen at Bilaspur on 27th November. Directly, however, the species became abundant on passage about the middle of March, such males were plentiful; the passage was still in evidence on 19th April. During the winter individuals are very sedentary and remain continuously in one area.

567. The Slaty-blue Flycatcher—*Cyornis leucomelanurus* (Hodg.)

A male was shot in a nulla above Kalka on 30th December and two more were seen in low hill jungle at Chandighar on 13th February. In both cases the elevation at which the birds were seen would be about 2,000-2,500 feet.

568. The White-browed Blue Flycatcher—*Cyornis superciliaris*, (Jerd.)

A pair were shot in the Rest-house compound at Chandighar on 26th March, and another male was seen there on the following day.

579. The Verditer Flycatcher—*Stoparola melanops* (Vig.)

Two were seen at Chandighar on 10th November, and a female was obtained there on 26th March.

592. The Grey-headed Flycatcher—*Culicicapa ceylonensis* (Sws.)

Observed at Chandighar, Jagadri, Bilaspur, Morinda, and Kharar during November and December; it was usually met with in the large shady mango-groves about these places, and there appeared to be an individual or two in almost every grove, each keeping roughly to its own beat. The loud scolding note was frequently to be heard and called attention to what was otherwise an inconspicuous little bird, spotted with difficulty, as it perched on fairly open boughs in the trees catching insects in the spaces amongst the foliage.

598*. The Indian Paradise Flycatcher—*Terpsiphone paradisi* (L.)

A fine male in the adult white plumage was shot in the jail garden on 3rd April, and a female or young male was also seen; a bird similar to the last was observed in the District Board garden on 7th April.

Beavan records: "I have observed several examples in the Chestnut plumage in the trees which line the main road between

Ambala and Kalka in March 1866; and Dr. Scott told me that he had occasionally seen specimens in the immediate neighbourhood of Ambala itself."

603. The Yellow-bellied Flycatcher—*Chelidorhynx hypoxanthum* (Blyth.)

Not uncommon; several were observed at Chandighar in the low-hill jungles on 13th February; single examples were also observed as follows: at Chandighar on 9th November, Bilaspur on 26th November, and at Mubariqpur on 19th and 21st of February. It is a bold self-possessed bird with little fear of human intruders and pirouettes and spreads its wings and tail with all the grace of a *Rhipidura*; it also sallies into the air after insects like the typical flycatchers.

In the Journal of the Bombay Natural History Society, Vol. XXIV, p. 357, Mr. A. E. Jones records that he obtained a specimen of this flycatcher near Ambala on 30th January 1915.

604. The White-browed Fantail Flycatcher—*Rhipidura albifrontata*, Frankl.

Common and generally distributed throughout the district; I also met with one in Kasauli on 8th March. A nest with 3 fresh eggs was found in the District Board garden built on a bough of a large Eucalyptus tree about 20 feet from the ground on 13th April.

Beavan says "also procured by me at Ambala, at the same time as the preceding [i.e., *R. albicollis.*], my first specimen being killed on the 30th October 1866, but it was apparently not so commonly distributed."

605. The White-throated Fantail Flycatcher—*Rhipidura albicollis.* (Vieill.)

So far Ambala is the only district in the Punjab where I have found this fantail flycatcher to be common; it is apparently more migratory than the last species and probably deserts the district during the hot weather. At any rate there were none at Chandighar at the end of March, though it had been as common as the last species there in November and February. It was also common at Mubariqpur in November and February, at Jagadri and Bilaspur in November, at Kalka in December, and a few were met with in Ambala on various dates between 23rd December and 29th January.

Beavan says: "not uncommon about Ambala in October and November 1866, my first specimen being procured there on the 29th October."

608. The Common Pied Bush-chat—*Pratincola caprata* (L.)

Beavan writes: "Kalka, April 1, 1867, this species is tolerably abundant about here now......they are plentiful between this and Dhurrumpore"; he also describes a female he obtained at Ambala on 12th November 1866. I found the species to be plentiful along the Kalka—Kasauli Road and in Kasauli itself from 5th to 10th March, and it was probably about to breed. I did not meet it in the Kalka nulahs in December. Otherwise in the plains, I only met with a male on 10th December and a few others from March 23rd, until my departure. For the most part it is probably a summer visitor only to the district.

610. The Indian Bush-chat—*Pratincola maura* (Pall.)

Common during the winter from November onwards; there was a very noticeable "rush" on migration through Ambala about the 14th and 15th April. The species doubtless breeds at Kasauli where I saw many from the 6th to 9th March.

Beavan records a specimen procured at Ambala on 22nd October 1866.

613. "Hodgson's Bush-chat—*Pratincola insignis* (Hodgs.)

Beavan: states "a specimen......procured at Lallroo near Ambala, on the 14th of November 1866 agrees with Dr. Jerdon's description......in having a conspicuous white-throat upper-tail coverts patch on tertials, and at the base of the primaries." Its description is given at length, but this record does not appear in the Fauna of India Birds, Vol. II, so the author would seem to have overlooked or discredited it.

615. The Dark-grey Bush-chat—*Oreicola ferrea* (Hodgs.)

A winter visitor in small numbers to the plains. On January 11th I shot a female which had been haunting the District Board garden since 26th December, and on February 8th I shot a male which had been about the jail garden since 14th January. Males were also seen at Kamalpur on 15th December, and at Mani Majra on 21st December.

618*. The Pied Chat—*Saxicola picata*, Blyth.

A male was observed at Chandighar on 10th November, and another was haunting my garden and verandah from 14th to the 21st of that month.

Beavan says: "I obtained a male at Ambala, October 23rd 1866, near the race course, and the next day a female in the same place."

619*. The White-headed Chat—*Saxicola capistrata*, Gould.

Beavan states: "I procured some specimens at Ambala in November 1866" and goes on to say that a male and female shot on 14th November at Lallroo were the only two of the species seen that day, though other chats were not uncommon.

620*. Strickland's Chat— *Saxicola opistholeuca*, Strickl.

Several were observed on different dates between 10th December and March 20th, but only at Rupar and Ambala.

Beavan states: "Ambala, November 12th, 1866.—I obtained a fine male......in Cantonments, near the race course."

625*. The Isabelline Chat—*Saxicola isabellina*, Cretz.

Beavan evidently refers to this species under the name of *S. œnanthe* when he says "all the specimens of this species procured in the cold weather of 1866 at Ambala....were in the dull winter plumage....a common species at Ambala....in the cold weather only". He obtained specimens on October 24th, November 10th and 14th.

626*. The Desert Chat—*Saxicola deserti*, Temm.

Beavan states: "This is perhaps the most abundant wheatear about Ambala" and gives details of specimens obtained on November 8th and 10th at Ambala. and on November 14th 1866 near Lallroo; on the last date in company with Dr. Scott he obtained six males and a female.

629. The Brown Rock Chat—*Cercomela fusca*, Blyth.

Probably a permanent resident. Several were seen during the winter in Ambala, and others were observed at Mubariqpur, Bilaspur, Rupar and Karar.

630. The Western Spotted Forktail—*Henicurus maculatus*, Vigors.

Several were seen in a nala close to Kalka on the Kasauli Road during the last week of December.

638. The White-capped Redstart—*Chimarrhornis leucocephalus* (Vig.)

I shot a male in the Nalahs at Chandigar on 12th February and saw one in a stream close to Kalka in the last week of December. Beavan states that he observed it on the streams of the lower hill range on the Simla cart road between Kalka and Dhurumpore. At Ambala on 12th November 4 specimens in the flesh were brought in by my shikari which he said he had procured in the neighbouring hills."

644. The Indian Redstart—*Ruticilla rufiventris* (Vieill).

This very abundant winter visitor had already arrived and was generally distributed when I arrived in the district; it remained common until the end of March and there were still some about during the first half of April, but I saw none after the 15th. None were observed in Kasauli during my visit in March, but there were a few in the Nalahs about Kalka in the last week of December.

647* The Red-spotted Bluethroat—*Cyanecula suecica*, (L.)

"Observed about Ambala in sugarcanes in 1865, tolerably abundant. Again at Ambala, October 24th, 1866, when I secured specimens". (Beavan.)

I found this Bluethroat to be numerous about Mubariqpur early in November; it was also I think common in the crops at Headquarters about that time. Then with the exception of 3 seen near Chamkaur on 12th and 13th December, I saw no more until 26th March, when a single specimen was found at Chandighar: another (perhaps a second) was seen at Ambala on 9th April.

657. The Blue-headed Robin—*Adelura cæruleicephala* (Vig.)

During the last week of December I found this Robin common in the more open parts of the low nalahs between Kalka and the Kasauli Road toll-gate; there were also some about the hill sides. From 6th to 9th March it was also fairly common on the open hill side in sparse Chir jungle on the north slope of Kasauli. The bird is not shy and as it flutters about the branches of trees, picking off insects and then sitting still for a space, the demeanour is that of a true Redstart. But the movement of the tail is more of a shake than the quiver of the latter.

661.* The Brown-backed Indian Robin—*Thamnobia cambaiensis* (Lath.)

Beavan has recorded: "Ambala, October 27th, 1866—I have noticed that this species, which is so abundant here a little later, and which breeds here in numbers in February and March, has almost entirely disappeared, and is conspicuous by its absence." This statement is referred to by Hume in his Nests and Eggs of Indian Birds (2nd Ed., Vol. II, p. 75), with the remark that he had not himself been able to verify the fact of the species being migratory. I however found it abundant throughout the winter, but noticed that it became more conspicuous about the beginning of March, when the approach of the breeding season made the males more noisy and active. In my opinion the species is strictly resident and non-migratory, but has the habit of moving about locally rather more than most resident species. It was not observed in Kasauli but was found in the Nalahs about Kalka both at the end of September and in March.

I found a nest with 3 hard set eggs on 3rd April; as usual the lining of the nest contained small pieces of cast snake's slough.

662.* The Black-backed Indian Robin—*Thamnobia fulicata* (L.)

Occurs in Dr. Scott's list with the locality Ambala, but I should view this record with suspicion until corroborated.

663. The Magpie Robin—*Copsychus saularis* (L.)

Common, generally distributed, and probably resident.

673. The Grey-headed Ouzel—*Merula castanea*, Gould.

One was seen at Kasauli on 10th March.

676.* The Grey-winged Ouzel—*Merula boulboul* (Lath.)

A party of some 5 or 6 of these Ouzels was met on 13th February in low hill jungle near Chandighar.

677.* The Black-throated Thrush—*Merula atrigularis* (Temm.)

Beavan's note on this species is as follows:— "According to information given to me by Dr. Scott, this species is tolerably abundant about Ambala in the cold weather, and several were procured by him, although it did not occur while I was there." In the 'Ibis' for 1869, p. 124, a paper on the plumages of Thrushes by Colonel Tytler includes descriptions of two males of this species procured at Ambala.

A few were met with about Ambala on November 16th, January 11th, during February, and on March 15th. The real stronghold however of this species as a winter visitor is in the low jungle clad hills to the north of the district. I found it most abundant in the bamboo jungle above Kalka during the last week of December, and there were still a few about there on March 10th, a flock of some 70 to 80 individuals was disturbed in the jungle at Chandigarh on 13th February.

693. The Western Blue Rockthrush—*Petrophila cyanus* (L.)

Two were seen, apparently both males, in some broken ground near Mani Majrah on 25th March, and a female was seen on a building in Cantonments on 10th April. They were of course on migration.

716. The Black-throated Accentor—*Tharrhaleus atrigularis*, (Brandt.)

A party of accentors seen close to the Patiala toll-gate on the Kasauli Road above Kalka on 28th December were referred to this species.

719. Jerdon's Accentor—*Tharrhaleus jerdoni* (Brooks.)

A male was shot in the Nalah above Kalka on the 30th December and one or two others were seen.

720. Blyth's Baya—*Ploceus baya*, Blyth.

Beavan records it as common near Ambala.

This species is probably for the most part a summer visitor as although I saw many old nests hanging on the trees about Chandighar, the only birds that I observed were a small party on 30th November on the road between Bilaspur and Jagadri.

734. The White-throated Munia— *Uroloncha malabarica* (L.)
Common and apparently resident.

738. The Indian Red Munia—*Sporæginthus amandava* (L.)
A few were seen near Mubariqpur on 6th November; at Chamkaur on 13th December I observed a couple of flocks in the belt of trees, bushes and pampas grass along the canal bank. This Munia is practically always found in the vicinity of water.

761.* The Common Rose-Finch—*Carpodacus erythrinus* (Pall.)
Included in Dr. Scott's list.

775.* The Yellow-throated Sparrow—*Gymnorhis flavicollis* (Frankl.)
In the more northerly parts of the Punjab I have been accustomed to find that this sparrow was a well marked migrant, common and breeding in the summer, and disappearing in winter. Hence it was with some surprise that I observed it to be very common, mostly in flocks, about Ambala during this winter, from the end of December onwards. These flocks were accustomed to feed on the ground in dense order, and when disturbed would fly into a neighbouring tree, and from thence gradually disperse, not leaving together. Towards the end of February the flocks showed signs of breaking up and by April the species seemed to be generally dispersed and preparing to breed.

776. The House Sparrow—*Passer domesticus*, L.
Abundant everywhere even occurring in Kasauli in company with the next species. Beavan includes it.

780. The Cinnamon Tree Sparrow—*Passer cinnamomeus*, Gould.
A solitary female was shot in the Bamboo jungle near Kalka on 30th December. During my visit to Kasauli in the early part of March I found this beautiful sparrow common, occurring round the houses and visiting the fields.

792. The Pine Bunting—*Emberiza leucocephala*, S. G. Gmel.
In the Journal of the Bombay Natural History Society, Vol. xxiv. p. 357, Mr. A. E. Jones records that in the early months of 1914 and 1915 he often came across these Buntings at Ambala.

793. The White-capped Bunting—*Emberiza stewarti*, Blyth.
From January 14th until April 19th I found these Buntings to be common in the neighbourhood of Ambala, wherein especial they where found to frequent a wilder part of the jail garden. Their usual habit when not feeding is to sit about stolidly in the leafless boughs of small trees, or to perch in bushes near the ground. The call is twittering and resembles that of the Linnet

It was also found in the low hills above Kalka on 28th December and early in March, some parties were seen at Chandighar on 26th March.

794. The Eastern Meadow Bunting--*Emberiza stracheyi*, Moore.
Several were seen in Kasauli on 6th March.

803.* The Crested Bunting—*Melophus melanicterus*, (Gm.)
"Found by the late Dr. Scott feeding in numbers on the ground at Ambala.' (Beavan.)

805. The Kashmir Martin—*Chelidon kashmiriensis*, Gould.

I obtained a male at Chandighar on 13th February when the species was abundant. On 5th March I saw a party of Swallows in a valley by Kalka which appeared to be of this species.

809.* The Indian Sand Martin—*Cotile sinensis* (Gray.)

Beavan says: "I observed this species in some abundance on the 1st April 1866, when on the March from Ambala to Kalka and within some 10 or 12 miles of the latter place." This probably refers to Mubariqpur where I found the species common in November and February: in the latter month it was breeding in the sandy banks of the Ghagger near the Rest House and I obtained eggs and skins. Sand Martins were common and widely distributed in the district throughout the cold weather.

810. The Crag Martin—*Ptyonoproghe rupestris* (Scop.)

A party of Martins, which I believe to have been of this species, were frequenting the Kasauli Road, above the water-works, on both the 6th and 10th March when I passed along.

811. The Dusky Crag Martin—*Ptyanoprogne concolor* (Sykes.)

Some were flying about the Bazaar at Chichrowli on 25th November, and a solitary specimen was observed by the canal at Kamalpur on 15th December.

(*To be continued.*)

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THE CYPERACEÆ OF THE BOMBAY PRESIDENCY.

BY

L. J. SEDGWICK, F.L.S., I.C.S.

The Flora of the Bombay Presidency by T. Cooke, the last part of which, containing the CYPERACEÆ and GRAMINEÆ was published in December 1908, is not entirely complete, and probably no family is so incomplete as the CYPERACEÆ. The idea of this paper is, therefore, to provide a more up-to-date flora of this family. The number of species given by Cooke is 102. To these I have added 20, *viz.*:—

Cyperus cephalotes *Vahl.*
,, platystylis *Br.*
,, (Pycreus) flavescens *L.*
,, distans *L.*
,, pilosus *Vahl.*
,, stoloniferus *Retz.*
,, esculentus *L.*
Marisus Sieberianus *Nees.*
Kyllinga brevifolia *Rottb.*
,, melanosperma *Nees.*
Fimbristylis acuminata *Vahl.*
,, tenera, *var.* oxylepis *Cke.*
Stenophyllus puberula (*Poir.*)
,, capillaris, *var.* trifida (*Kunth.*).
Scirpus mucronatus *L.*
,, erectus *Poir.*
Lipocarpha argentea *Br.*
,, sphacelata *Kunth.*
Scleria caricina *Benth.*
,, elata *Thw.*

It is noticeable that several of these where collected by the late Mr. Talbot as early as 1884, which makes it clear that Cooke did not have the advantage of using the Talbot Herbarium when writing the last part of his Flora. As against these 19 added species I have excluded 6 out of those given by Cooke, *viz.*:—

Cyperus pulcherrimus *Willd.*
,, corymbosus *Rottb.*
Fimbristylis monticola *Hochst.*
Scirpus kyllingoides *Boeck.*
Rhyncospora Wallichiana *Kunth.*
Carex condensata *Nees*,—

mentioning in each case the reason for their exclusion.

The material on which this paper is based are the sheets in the Herbarium of the Economic Botanist and the Talbot Herbarium, both of them kindly lent me by Dr. H. H. Mann, the Principal of the College of Agriculture, Poona,—a vast quantity of material collected by Father Blatter and Mr. Hallberg of the St. Xavier's College, Bombay, and kindly lent to me by them,—and the collections made by myself in the Ahmedabad District and in the Dharwar District and adjacent parts of North Kanara.

As this paper was unavoidably prepared far from civilization I have had virtually no literature to help me except the Flora of British India and Cooke's Flora. Through the kindness of Dr. Mann I was lent the volume of "Illustrations of Cyperaceæ," London, 1909, a posthumous work of C. B. Clarke, and this has been useful in one or two cases. But very few of the Bombay Cyperaceæ are figured there; and a few systematic puzzles have arisen, which I have thought better to leave unsolved, but merely stated, rather than to attempt a solution by describing new or reducing existing species without seeing Clarke's other posthumous notes, as well as monographs of other cyperologists, which may have been published since Cooke wrote. For the same reason it has been out of the question to attempt anything in the way of synonymy; and I have, therefore, given synonyms only in cases where the Flora of B. I. and Cooke's Bombay Flora differ.

This paper is intended to be essentially a practical guide in field work. I have framed my clavises as practically as possible; and in the matter of habitat and distribution I have given them as broadly as is possible at the present day, not citing particular places or names of collector except for very rare species. It is to be regretted that there is practically no available material from Sind. But the probability of any species occurring there or not can be deduced from the distribution given for the Presidency proper.

Cyperaceæ. English :—" Sedges.'

Annual or perennial herbs with the habit of grasses or rushes. *Root system* various. *Stems* solid, usually trigonous, sometimes terete or polygonal, usually simple. *Phyllotaxy* $\frac{1}{3}$, constant. *Leaves* never petiolate, composed of a closed sheath and a free blade, which is occasionally absent. *Ligule* 0. *Inflorescence*—(1) in SCIRPOIDEÆ typically a simple or compound bracteate umbel of spikelets, often a capitate cluster of sessile spikelets, or a single spikelet,—(2) in CARICOIDEÆ typically a number of paniculately arranged spikes, often a single spike. *Spikelets* 1-many flowered. *Flowers* glumaceous, 1-2-sexual, typically a bisexual floret in the axil of a single glume. Palea 0. *Perianth* 0, or of 2 or more hypogynous bristles or scales, or (in CAREX) of a utricle enclosing the ovary. *Stamens* 1—3; filaments flattened; anthers linear, basifixed, dehiscing ventrally by longitudinal slits. *Pollen* light, granular, conveyed by wind. *Ovary* superior, 1-celled, consisting of 3 (or, by suppression, 2) wholly combined carpels, free (except in CAREX), compressed or trigonous. *Ovule* solitary, basal, erect, anatropous. *Style* short or long, terete or flattened, 2- or 3-partite. *Stigmas* as many as the style-branches, always exerted. *Fruit* a nutlet, usually trigonous or compressed, free (except in CAREX). *Seed* erect, free. *Embryo* minute, within the base of the usually floury albumen.

(Genera about 65, species about 3,000, universally distributed).

It is customary to speak of the inflorescence of the *Scirpoideæ* as an umbel. The umbel is, however seldom as perfectly regular and flat-topped as in such families as *Umbelliferæ*, *Asclepiadaceæ*, etc. An umbel may be either monopodial or sympodial. That the scirpoid umbel is monopodial can be clearly seen from such plants as *Cyperus bulbosus* and *C. alternifolius* ("Umbrella-grass" of Anglo-Indians), where the contraction of the main rachis at the base of the inflorescence is not so complete as to prevent the development of a branch (umbel ray) from the axil of each bract. The secondary branchings of the primary rays however often give the appearance of being sympodial (cymose) especially in such supra-decompound forms as *Fimbristylis quinquangularis* and *Scirpus grossus*. In some of the *Caricoideæ* the ultimate branchings, and even the spikelet itself, seem to be certainly cymose.

In the *Caricoideæ* the morphology of the spikelet is often a matter of doubt. For instance, the utricle of *Carex* and the spike or spikelet of *Hypolytrum* are variously regarded by different authors. It would be beyond the scope of this paper go into any detailed discussion of these points, especially as these genera are poorly represented.

The *Cyperaceæ* form a satisfactory family of fairly constant habit. They are usually recognizable at once by their 3-angled stems, which distinguish them from grasses. The species with terete or polygonal stems are recognizable by their 3-ranked leaves or leaf-sheaths, the leaves of grasses being always 2-ranked, by the sheath being perfect and not split down the front as in grasses, and by the bracteate inflorescence. The *Juncaceæ* ("rushes") can be distinguished by having a definite perianth and 3-celled capsule of the Liliaceous type. The discrimination of some species of *Eriocaulon* ("Hat-pin grasses") from some Cyperaceous forms such as *Eleocharis* is a matter of more difficulty. As a rule the *Eriocaulaceæ* can be distinguished by their dense rosettes of succulent radical leaves. Failing this the inflorescence must be dissected. The *Eriocaulaceæ* have a three-celled capsule containing separate seeds, and the whole morphology of their flowers is quite different.

The "sedges" are typically denizens of marshes, though some species inhabit dry localities and even deserts, and some forests.

Though so closely allied to grasses the "sedges," are of little economic importance, being as a rule very poor fodder. The ancient "papyrus" was made from the stems of *Cyperus papyrus*, Linn., a Nile plant. Of the Indian sedges a few have edible tubers or bulbous stem-bases. The stems and leaves of some are used for mats. From the tubers of *Cyperus rotundus*, Linn., is obtained the fragrant powder used in the "agarbattis", or fragrant tapers burned in Hindu temples and houses. The same species is a notable pest in agricultural land.

KEY TO THE GENERA.

I. SCIRPOIDEÆ. Primary branching of the inflorescence usually umbellate (*i.e.*, of several closely-placed rays subtended by several bracts), or spikelets in a contracted head, or spikelet solitary (reduced umbels). Spikelets always 2-sexual. Florets usually ☿. Nut free, but concealed or partially concealed by its glume, even when ripe.

A Flowering glumes all distichously arranged on a flattened or subquadrangular rhachilla. Hypogynous bristles 0. (CYPEREÆ).

1. Rhachilla not disarticulating above the two lowest glumes, but the fertile glumes and nuts ultimately deciduous from the permanent rhachilla. Spikelets many-flowered, elongate .. 1. *Cyperus*.
2. Rhachilla disarticulating above the two lowest (empty) glumes, falling away with its fertile glumes and nuts, leaving a knob on the rhachis.
    (*a*) Spikelets 1—many-flowered, elongate, usually spikately arranged on the branches of a true umbel, sometimes capitate ; style 3-fid .. 2. *Mariscus*.

(*b*) Spikelets 1—2-flowered, ovoid, pale (white or greenish), crowded in dense globose or cylindric solitary or capitately arranged spikes. Glumes slightly winged on the keel; style 2-fid. 3. *Kyllinga.*

(*c*) Spikelets 1—3-flowered, ovoid, golden-yellow, in globose heads on the branches of an open umbel. Keels of fertile glumes with cotinuous glistening wing; style 3-fid .. .. 4. *Courtoisia.*

B. Flowering glumes all spirally arranged around a terete or polygonal rhachilla. Hypogynous bristles or scales often present. (SCIRPEÆ.)

1. Hypogynous bristles or scales 0. (See also *Scirpus*).

(*a*) Style-base swollen, constricted above its point of insertion on the nut, leaving no prominence on the nut after dehiscence .. .. .. 5. *Fimbristylis.*

(*b*) Style-base swollen, constricted above its point of insertion on the nut, leaving an apical (usually dark) tumour on the (usually white) nut after dehiscence. Leaves very finely capillary and with the rest of the plant often puberulous .. .. 6. *Stenophyllus.*

2. Hypogynous bristles or scales present (absent in those species of *Scirpus* whose nearest affinities are with that genus).

(i) Nut with hypogynous bristles (exception as above).

(*a*) Spikelets solitary, terminating the stems. Leaves 0. .. .. 7. *Eleocharis.*

(*b*) Spikelets several or many (in the Bombay species.) Leaves present or not .. .. 8. *Scirpus.*

(ii) Nut with hypogynous scales, or scales and bristles (bristles only in one sp. of *Fuirena*).

(*a*) Hyp. scales 6, divided to the base into innumerable hairlike segments .. .. 9. *Eriophorum.*

(*b*) Hyp. processes 6, in two series, the outer (sepals) typically bristles, the inner (petals) typically scales; sometimes one or both (in non-Bombay) species reduced .. .. .. 10. *Fuirena.*

(*c*) Hyp. scales 2, closely adhering to the nut, and difficult to discern (two species both with compact heads of several stout spikelets) .. 11. *Lipocarpha.*

II. CARICOIDEÆ. Primary branching of the inflorescence usually paniculate (*i.e.*, of a terminal panicle as well as of partial panicles from the axils of the stem leaves), or of several capitately crowded spikes or a single spike (reduced panicles). Stem generally leafy upwards. Spikelets 1-2-sexual. Florets less commonly ♀, usually 1-sexual and monoecious.

A. Nut not enclosed in a utricle.

(i) Nut dark, cylindric or compressed, usually beaked.

(*a*) A maritime herb with crowded pungent, recurved leaves, and very short, ovoid or oblong, capitately arranged spikelets .. 12. *Remirea.*

(*b*) Inland herbs. Spikelets golden yellow, acute, bearing one beaked nut. Bristles usually present .. .. 13. *Rhyncospora.*

(c) A stout herb of streams in dense forest with long and very broad 3-nerved leaves. Spikelets (spikes) obtuse with many obtuse glumes. Bristles 0. Scales 2 .. .. 14. *Hypolytrum.*

2. Nut prominently exserted (except in *S. caricina*) globose or globosely ovoid, osseous, white and glabrous or puberulous with reddish hairs, smooth or variously sculptured. Inflorescence panicled .. .. 15. *Scleria.*

B. Nut enclosed in a bottle-shaped utricle with an entire or bifid beak .. .. 16. *Carex.*

1. **Cyperus,** *Linn.*

Annual or perennial glabrous herbs. Root system various. Leaves from sheathes without blades to very long and prominent. Inflorescence capitate or umbellate, subtended by foliaceous bracts. Spikelets many-flowered. Glumes fertile except the two lowest and the few terminal. Stamens 1-3. Stigmas 2-3 (v. rarely 1). Nut compressed or trigonous. Habitat various. (Species nearly 400 almost all over the world).

I have followed Cooke in including under *Cyperus* the genera *Pycreus* and *Juncellus* of the F. B. I., but have differed from him in maintaining *Mariscus* as a separate genus. In the case of the two former the characters relied upon by those authors who regard them as genera are the compressed (not trigonous) nut, and the 2 (not 3) style-branches. The same characters could however be equally well relied on to break up the genera *Scirpus* and *Fimbristylis.* Moreover in at any rate some of the species of *Juncellus* the suppression of the third carpel is sometimes incomplete, as is shown by the fact that in the same individual there may be either two or three stigmas, while the nut is obscurely three-sided. In the case of *Mariscus* the disarticulation of the rhachilla seems to be an important morphological character. In the *Gramineæ* the morphology of the rhachilla is regarded as of generic importance and on the same analogy it should be so regarded in the *Cyperaceæ* also. Nor is Coke correct when he says that this character "cannot be applied in the field, but may be said to be limited to herbarium specimens" (F. B. P. II, p. 853). As a matter of fact when a *Mariscus* is ripe the spikelets come off in handfuls on the merest touch even when the plant is standing. Articulations are not usually apparent when the parts are immature. But this applies to many other morphological characters which are used in systematic botany. Lastly, in most species of *Mariscus* the morphology of the spikelet, including shape of glume and shape of nut, is very much removed from the typical *Cyperus* spikelet, which certainly cannot be said of *Pycreus* or *Juncellus.*

Sub-genus I (ANOSPORUM) *Nut corky below or on the angles-Tank-floaters.*

1. **C. Cephalotes,** *Vahl.* Stoloniferus—floating in tanks. Leafy. Bracts long. Infl. a dense head of pale, many-flowered spikelets. Style v. long, almost entire or slightly 3-notched at the tip. Nut with a thickened, white, corky base, enabling seed dispersal by water.

Forming floating islands in association with *Pistia Stratiotes* in a very few tanks in the above Ghat Talukas of Kanara. (Indo-Malayan and E. Asian).

2. **C. platystylis,** *Br.* Stoloniferous, floating in tanks. Leafy, stems strong, 2-3 ft. Leaves broad, scabrid, cutting the hand. Umbel broader than long, compound. Bracts long, leafy. Spikelets numerous, digitate on the rays, elongate, flattened, linear, parallel-sided, 20—40-flowered, brown. Nut triquetrous (or trigonous) one side much broader than the others, angles whitish.

V. rare. Tank near the Devimana ghat, N. Kanara (H. Agr. Coll.), (Indo-Malayan).

Sub-Genus II (PYCREUS). Nut laterally compressed—Stigmas 2.
Key to the subgenus:—

A.—*Superficial cells of the nut longitudinally elongate. Ripe nuts usually appearing irregularly zonate by the short sides of the cells running into a wavy line.*

(*Note.*—The species of this section are very imperfectly characterized.)

1. Nut black, narrowly obovoid, subacute, not much compressed, the transverse ridges prominent, glistening white .. 3. *C. flavescens.*
2. Nut black, broadly obovoid, obtuse, rather compressed, the transverse ridges distinct, not white .. .. .. 4. *C. latespicatus.*
3. Nut black, quite concolorous, almost completely rotund, very compressed, the transverse ridges rather obscure .. 5. *C. Malabaricus.*

B.—*Superficial cells of the nut quadrate. Ripe nuts not zonate.*

1. Spikelets short, broad, $\frac{1}{8}$ in, redish .. 6. *C. sanguinolentus.*
2. Spikelets elongate, many-flowered, with parallel sides, $\frac{1}{8}$ in, stem robust, 1-2 ft. .. .. 7. *C. puncticulatus.*
3. Spikelets gradually attenuated from base to tip, glumes lax, yellow, with prominent white margin .. .. 8. *C. albomarginatus.*
4. Spikelets elongate (as 2) but stems slender, tufted, 8-18 inches .. .. 9. *C. globosus.*
5. Spikelets narrow, pale, in contracted umbels; perennial, maritime .. .. 10. *C. odoratus.*
6. Small and slender; spikelets few-flowered with hump-backed glumes with strong raised, curving nerves on the sides .. .. 11. *C. hyalinus.*
7. Small and slender, spikelets many-flowered, elongate, parallel-sided, with normal glumes .. .. 12. *C. pumilus.*

3. **C. flavescens,** *Linn. P. flavescens,* Nees; and incl. *P. stramineus* Cke. Annual, slender, 1-12 inches. Umbel simple, small, with few short slender rays and few rather short spikelets $\frac{1}{4} \times \frac{1}{10}$ inch, compressed, dark with rather light margins all round the glumes. Nuts as clavis.

Besides material from Mt. Abu there is one specimen from Maval, Poona Dist. in Herb. St. X. Coll. The plant is liable to be passed over as resembling poor forms of *C. globosus* and *C. Malabaricus.*

I cannot from descriptions in F. B. I. distinguished Clarke's *P. stramineus* The colour of the spikelets of the Abu and Maval specimens is darker than described in F. B. I. but the shape and appearance of the nut seems to leave no doubt that they are not *C. Malabaricus,* which they otherwise resemble.

4. **C. latespicatus,** *Boeck.* *P. latespicatus* Cke. Rather stouter in the stem, 4-16 inches. Umbel as the last but spikelets more numerous and larger, $\frac{5}{8} \times \frac{1}{5}$ in., not so compressed, bullate from the ripe-nuts, yellowish brown, concolorous, parallel-sided, obtuse. Nut as clavis.

Occasional throughout the ghats and adjacent regions. (Scattered throughout India).

5. **C. Malabaricus,** *T. Cooke.* (F. B. P. II, p. 856) *P. Malabaricus* Cke. as No. 3 above, but nut as clavis, and glumes very dark with prominent paler margin all round. In the Bombay examples the spikelets are not conspicuously parallel-sided.

Distribution of the last. (App. endemic in W. India).

6. **C. sanguinolentus,** *Vahl.* *P. sanguinolentus,* Nees. Rhizome creeping. Stems 4-20 inches, strong, either erect or decumbent at the base, leafy up to sometimes one-third of the stem. Umbel simple, often contracted. Spikelets few, about $\frac{3}{8} \times \frac{1}{6}$ in. dark red, not very compressed, bullate from the ripe nuts, tapering to the sub-obtuse tip. Nuts sub-rotund, dark, apiculate.

Fairly common in the ghat tracts and the regions adjacent, in marshes. (Warm regions of the old world).

7. **C. puncticulatus,** *Vahl.* *P. puncticulatus,* Cke. Stems sub-solitary, robust, 1-2 ft. Leaves rather thick. Umbel large, simple or compound, with rays up to 6 inches. Spikelets many, distant on the rhachis, pale or reddish brown, rather many-flowered, $\frac{1}{2} \times \frac{1}{8}$ in. (width $\frac{1}{10}$—$\frac{1}{8}$ in. Cooke, $\frac{1}{6}$ in. Clarke) parallel-sided. Nut dark, obovate, obcordate, apiculate.

App. very rare. Heavy rainfall regions in the South of the Presidency (Deccan Peninsula of India, Ceylon, China).

8. **C. albomarginatus,** *Mart.* and *Schrad.* *P. albomarginatus,* Nees. Tall, 1-3 ft., stems solitary. Umbel small or quite large with rays up to 7 inches. Spikelets distant on the rhachis, $\frac{3}{4}$ in. as clavis. A very distinct species.

Konkan, ghats and sub-ghat tracts. Fairly common in marshes. (India. W. Peninsula. Burmah. Tropics generally.)

9. **C. globosus,** *All.* *P. globosus,* Reich. *P. capillaris,* Nees. Slender, tufted, 8-18 in. spikelets crowded in heads or simple umbels with few short rays, very many-flowered, conspicuously parallel-sided, $\frac{3}{4} \times \frac{1}{10}$ in., pale in North, dark in South India, and with yellow margins to the glumes. Nut obovoid, dark, smooth. *C. malabaricus* is very close to this especially as the nut is very often only very slightly reticulated when young.

A very abundant sedge of rice-fields and other damp places throughout the Presidency. (Old world).

10. **C. odoratus,** *Linn. C. polystachyos,* Rottb. *Pycreus polystachyos Beauv.* Perennial, tufted, 1-2½ ft., base thickened. Stem sometimes obsolete. Umbel simple with very short rays, or contracted into one head. Spikelets many. v. narrow, $\frac{2}{3} \times \frac{1}{1}$ in. pale, sub-erect, even in fruit, very many-flowered. Nut brown, oblong-ellipsoid, apiculate.

Coasts of the Presidency and the regions just inland, app. very rare. (All warm regions, mainly maritime).

11. **C. hyalinus,** *Vahl. C. pumilus,* Nees. *P. pumilus,* Nees. Annual, small, slender, 2-8 inches. Umbels simple with few short rays or reduced to a head. Spikelets $\frac{1}{4} \times \frac{1}{8}$ in., yellowish, about 7-flowered, much compressed. Glumes of a very unusual shape, back (which is strongly nerved) curved convexly and then shortly recurved at the apex, something like a question mark; sides with several very strong raised nerves, radiating from the base of the glume, and then curving along the sides parallel to the curve of the back. Nut brown, obliquely oblong, obovate. A very distinct species.

Very rare. Apparently only from Sion, Bombay. (India, W. Peninsula, Ceylon, Timor).

12. **C. pumilus,** *Linn. C. nitens,* Vahl. *P. nitens,* Nees. A small tufted annual, 2-8 inches. Spikelets in terminal heads (or occasionally the head umbellately broken up), very many-flowered, exactly parallel-sided, $\frac{3}{8} \times \frac{1}{12}$ in., very pale, glumes with a short cuspidate point, spreading in fruit.

Throughout the Presidency, but rarer in the South. One of the commonest sedges on sand in the drier northern tracts and thence onward into the desert. (Warm—presumably drier—regions of the old world).

Subgenus III.—(JUNCELLUS)—*Nut dorsally compressed—Stigmas 2 or 3.*

Key to the sub-genus :—

(*a*) A dwarf herb, spikelets close packed in a small terminal head .. .. .. 13. *C. pygmaeus.*
(*b*) A glaucous herb, about 1 ft. high, spikelets in a small, apparently lateral head .. 14. *C. laevigatus.*
(*c*) A tall stout herb, spikelets in a large compound umbel .. .. 15. *C. alopecuroides.*

13. **C. pygmaeus,** *Rottb.* Stems only a few inches high, densely tufted and ring from leafy bases. Heads dense, ¼ in. in diam. Bracts several, large, spikelets ovate, small, green maturing to pale brown. Glumes closely imbricate, acute or cuspidate, with strong green keel and hyaline sides. Nut minute, elipsoid, acute, flat on the ventral. convex or sub-angular on the dorsal side brown. Closely resembles *Scirpus Michelianus* (q. v.).

A gregarious herb of dried rice-fields or the margins of tanks below high flood-level. Abundant throughout the Presidency. (Most warm countries of the old world).

14. **C. laevigatus,** *Linn.* Rhizome creeping in mud. Stems solitary or tufted, sheathed below, leafless or almost so, pale. Heads compact. Bracts 2, the lower erect like a continuation of the stem, the upper very small or O. Spikelets pale. Glumes closely imbricate broadly boat-shaped with acute tips. Nut obtuse, plano-convex.

A gregarious rhizomatous herb of soft mud. In the beds of nullahs and similar localities, common throughout the Presidency. (Most warm countries).

(*b*) *Var* **junciformis,** *Clarke.* Spikelets few, rigid, shining, chestnut or black.

Sind, Stocks 751 in Herb. Kew. No specimens are available now.

15. **C. alopecuroides,** *Rottb.* Tall, 2-3 ft. Stem thick. Leaves and bracts long and broad. Umbel large, compound. Spikelets in dense spikes, terminating the rays of the secondary umbels. Glumes closely imbricate, with thick green, sometimes slightly excurrent keel, pale sides, and a very narrow wavy, glistening margin. Nut very small for the size of the plant, shortly ellipsoid, acute, plano-convex, pale but darkening to ashy brown with age. Stigmas indiscriminately 2 or 3 on the same plant.

A large solitary herb of standing or running water. Common throughout the Presidency. (India and Ceylon, tropical Africa and Australia).

Sub-genus IV (CYPERUS)—Nut trigonous, stigmas 3.

Section 1. *Spikelets digitate on the ultimate rays, not spikate.*

Key to the Section :—

A. *Annuals with fibrous roots (except C. Haspan).*
1. Glumes mucronate
(*a*) Spikelets $\frac{1}{5}$-$\frac{1}{4}$ in. broad, reddish .. .. 16. *C. teneriffæ.*
(*b*) Spikelets narrow, nut obovoid .. .. 17. *C. uncinatus.*
(*c*) Spikelets very narrow, nut exactly oblong. 18. *C. castaneus.*
2. Glumes not mucronate
(*a*) Spikelets innumerable in globose heads, green to blackish .. .. 19. *C. difformis.*
(*b*) Spikelets fewer in each head, golden yellow
(i) No stolons, nut globosely trigonous, granulate .. .. 20. *C. flavidus.*
(ii) Stoloniferous, nut usually triquetrous. 21. *C. haspan.*
B. *A perennial with short rhizome and globose whitish heads. A plant of heavy rainfall tracts* .. .. 22. *C. leucocephalus.*
C. *Perennials with rhizomes creeping in sand. Plants of sandy shores and desert tracts.*
1. Spikelets in one head, dirty straw coloured .. 23. *C. arenarius.*
2. Spikelets in one head, pure white .. 24. *C. niveus*

3. Spikelets in a contracted umbel, pinkish grey, roots wooly .. .. .. 25. *C. conglomeratus.*
4. Spikelets in a contracted umbel, roots wiry. 26. *C. atkinsoni.*

16. **C. teneriffæ,** *Poir.* 2-4 inches high, rarely more, tufted. Spikelets usually few, large for the size of the plant, bearing a superficial resemblance to the spikelets of *C. compressus.*

Barren waste land, occasional in the Deccan and Carnatic. (Indo-African).

17. **C. uncinatus,** *Poir.* (in Cooke's F.B.P.). *C. cuspidatus*, H. B. and K., in F.B.I. 3-6 inches high. Tufted. Spikelets small and narrow. Nut minute, obovoid.

Very rare. Specimens from Igatpuri in Herb. St. Xavier College are not certainly allocable to this species or the next for want of mature nuts. (African and E. Asian).

18. **C. castaneus,** *Willd.* 1-7 inches high. Tufted. Spikelets very small and narrow, dark chestnut. Nut minute, exactly oblong.

Very rare, Konkan. (Scattered throughout S. E. Asia.)

Note.—Here belongs *C. pulcherrimus*, Willd., given by Cooke on the strength of the record " Sind, Pinwill" in F. B. I. It is very close to the next, but has more numerous umbel rays and crisped incurved tips to the glumes. It should not occur in Sind, being a plant of the inner Indo-Malayan region.

19. **C. difformis,** *Linn.* Very variable in size, from 4 inches to 2 feet. Stems flaccid triquetrous, bracts long, leafy. Inflorescence of one head or of several umbelled globose heads of innumerable, densely-crowded, short, very narrow spikelets, green when young, almost always dark-brown or blackish when ripe. Glumes short, very obtuse.

Abundant throughout the whole Presidency in damp places, or in standing or running water. (Warm regions of the old world).

20. **C. flavidus,** *Retz.* 1 inch to 1 foot. Tufted but not densely so. Stem flaccid. Umbels compound or decompound with long rays, occupying most of the plant. Bracts long. Spikelets $\frac{1}{4}$ inch, very narrow, very acute, golden yellow, stellately spreading from the tips of the rays. Glumes oblong with rounded hyaline tips and hyaline sides. Nut minute (as clavis) white.

A very abundant weed of rice-fields throughout the Presidency. (Warm regions of the old world).

21. **C. Haspan,** *Linn.* Closely resembles the last, but larger in all its parts and with a creeping slender rhizome. Nut as clavis, but probably would have obtuse faces in a perfectly mature state, white in the Bombay examples.

Apparently rare, the only authentic specimens being from nullahs and rivulets in open places on the crest of the Southern Ghats. (All warm regions).

Probably *C. flavidus* is only a smaller annual form of this plant.

22. **C. leucocephalus,** *Retz.* Rhizome short woody. Stems numerous 6-12 inches, each with a solitary globose head of small white spikelets. Bracts spreading and deflexed. Nut oblong-ellipsoid, apiculate, black, rough. Habit of a *Kyllinga.*

In open spaces in forests in the heavy rainfall belt on the crest of the Southern Ghats. Flowers only in the early monsoon and common at that time in the habitat given. (Tropics generally, presumably only in the wetter regions).

23. **C. arenarius,** *Retz.* Rhizome wiry, far-creeping in sand. Stems distant on the rhizome, wiry, 6-10 inches. Spikelets short, broad, often almost amorphous, dirty straw-coloured, in solitary globose heads. Nut obovoid, dark.

On sand either on sea-shores or inland (in North Gujarat and Sind), not uncommon. (Perso-Arabian and Indian).

24. **C. niveus,** *Retz.* Rhizome woody. Stems approximate, 6-10 inches. Spikelets large, many-flowered, white. Glumes shortly mucronate at or below the apex, multi-striate. Nut obovoid triquetrous, ultimately dark.

On dry hills and banks, Sind and North Gujarat. (From Afghanistan to China occasionally spreading southwards in drier India).

25. **C. conglomeratus,** *Rottb.* Rhizome woody, roots often woolly. Stems 6-20 inches. Spikelets few-flowered, softly pinkish grey, in sessile and shortly umbellate heads. Glumes shortly mucronate. Nut unequally trigonous, ultimately dark.

Sind and North Gujarat in sand. (Westward to the Mediterranean).

(*b*) *Var,* **pachyrhizus,** *Trimen.* (Sp. *Nees*) A maritime form, with very thick crowded stem-bases, clothed with brightly-coloured sheaths, and heads up to 2 inches across bearing more numerous spikelets.

Coast of Kathiawar and the North Konkan. (Also Ceylon and the Laccadive Is.)

[**C. effusus,** *Rottb.* Like the last sp. but with many-flowered spikelets with densely crowded glumes.

Sind, Pinwill (*Ex* F. B. I.). This should occur in Sind.]

26. **C. atkinsoni,** *Clarke.* Like *C. conglomeratus*, but roots not woolly and spikelets pale-brown, rather many-flowered.

Karachi—Stocks (*Ex.* F. B. I.) (Afghan.)

Section II—*Spikelets spikate or racemose not digitate.*

A.—*Small annual with squarrose glumes.*

27. **C. aristatus,** *Rottb.* 3-6 inches, tufted, very slender, Umbel capitate or simple with short rays. Spikelets golden yellow, often very closely spikate, $\frac{1}{4} \times \frac{1}{5}$ inch. Glumes with a long squarrosely recurved arista. Usually placed here on account of the shortly spikate spikelets, but all its affinities are with species 16-18.

An abundant weed throughout the Presidency. (Tropics generally).

Note.—Some of the very abundant Bombay material shows spikelets deciduous as in *Mariscus*, which would seem to approximate to *M. squarrosus* Clarke. But as all specimens show the typical striate glumes of *C. aristatus*, and as neither Clarke's description nor his illustration indicate the striate condition I have had to leave all the material in this species.

B.—*Medium annual with compressed spikelets.*

28. **C. compressus,** *Linn.* Annual 5-16 inches. Umbels with few rays. Spikelets $1 \times \frac{1}{5}$ inch, compressed but with a median ridge on each side (so that a cross-section would be diamond-shaped), usually greenish. Glumes with a compressed very slightly recurved mucro.

Fairly common in dry ground, especially cultivated land, throughout the Presidency (Tropics generally).

C.—*Medium annual with distant, obtuse, golden yellow glumes.*

29. **C. Iria,** *Linn.* Annual, very variable, 4 ins. to 2 ft. Umbel simple or compound. Spikelets normally $\frac{1}{4} \times \frac{1}{10}$ inch. 6-20 flowered (often much less), spreading or secund, always golden yellow. Glumes distant, very obtuse, almost globose, with hyaline margins. Nut shortly obovoid.

Very abundant throughout the Presidency, usually in damp places. (Warm regions of the old world).

(*b*) *Var*, **paniciformis,** *Clarke.* Spikelets with 1-4 flowers, very secund, on spikes which are drawn out into almost linear racemes.

Standing or running water, especially in North Gujarat. Taller than the type. A distinct variety, but the type is so variable that many individuals show the tendency to develop few flowered secund spikelets.

(*c*) A very slender form, with filiform stems 4-10 inches; lowest bract erect, filiform, like a continuation of the stem. Umbel rays few and short. Spikelets few but of normal size.

Ghats and Konkan, (Herb, St. X. Coll.—a good many collections).

D.—*Perennials. Rhachilla of spikelets not much winged, slender. Glumes (mature) with concave backs, not appressed.*

Key to the Subsection :—

1.	Spikelets very slender, almost filiform, spreading stellately, glumes very distant ..	30. *C. distans.*
2.	Spikelets less slender, secund, in tassel-like clusters on the ends of the very long rays.	31. *C. nutans.*
3.	Spikelets less slender, firm, erect or spreading	32. *C. elеusinoides.*

30. **C. distans,** *Linn.* Usually about 2 feet. Slender. Umbel large, occupying nearly half the plant, compound, with numerous spreading rays. Spikelets as clavis, red or dark-brown, rhachilla filiform, wavy.

Apparently rare. Only authentic specimen from Castle Rock (Herb Agr. Coll.) (All warm regions).

31. **C. nutans,** *Vahl.* 2-3½ ft. Umbel with very long ray and secondary rays. Clusters (mature) drooping.

Apparently rare. Scattered throughout the Southern Ghat region (India generally).

32. **C. eleusinoides,** *Kunth.* 1½-4 ft. Umbel small or large according to general development. Spikelets crowded on the ultimate rays, supported by bracteoles, almost always erect. Glumes not very distant, but loosely spreading with hollow curved back. Easily recognised when known, but not very easy to describe.

Abundant throughout the Presidency in standing or running water. (Warm regions of the old world).

E.—*Leafy perennials. Spikelets compressed. Glumes closely imbricating with scarious margins and tips. Tall herbs of marshes.*

Key to the Subsection :—

1.	Rhachis of spike pilose-scabrid	31. *C. pilosus.*
2.	Rhachis of spike glabrous	32. *C. procerus.*

33. **C. pilosus,** *Vahl.* Upto 3. ft. Umbel medium-sized, compound. Spikelets distant on the hairy rhachis, spreading at right angles about ⅜ × ½ inch, dark-coloured, acute, margins of glumes hyaline white.

In marshes in the Mallad tract of the Carnatic, not uncommon. Occasional further North. (Tropics except America).

34. **C. procerus,** *Rottb.* Upto 3 feet. Umbel usually not very large for the size of the plant. Spikelets rather distant, larger than *pilosus*, 1 × ⅙ inches, bright red or paler (when young), not very acute. Margins of glumes hyaline white.

In marshes in the Mallad tract, of the Carnatic, often gregarious, not uncommon. (E. Asia).

F.—*Maritime herbs with terete pale spikelets.*

Key to the Subsection :—

1.	Glumes crisply incurved all round .. .	35. *C. malaccensis.*
2.	Glumes appressed	36. *C. stoloniferus.*

35. **C. malaccensis,** *Lam.* Rhizome creeping. Stems 1½-3 ft. Stem triquetrous almost three-winged at top. Leaves few, short. Umbel small for the size of the plant. Bracts leafy. Spikelets ½ × 1/20 inch, as clavis.

In brackish mud, Konkan Coasts. App. rare, (Asian and Australian, maritime).

36. **C. stoloniferus,** *Retz.* Rhizome creeping. Stems leafy 4-8 in. usually (Clarke in F. B. I.) 14-16 inches in the Bombay example, nodose at the base and clothed for some way (in the Bombay example) with lacerated coloured sheaths, trigonous at top. Umbel small and contracted, spikelets terete, $\frac{1}{2} \times \frac{1}{16}$ inch (in the Bombay example). Glumes closely imbricating, obtuse, dirty white, speckled with pink on the back.

I conclude that this is No. 2741 in Herb. St. X. Coll. from the shore at Mahim, Bombay. (Shores of E. Asia.)

G.—*Tall glabrous rhizomatous plants, almost leafless. Stems terete, spongy, often appearing transversely septate when dry. Umbels small for the size of the plant. Bracts very short. Spikelets pale.*

37. **C. articulatus,** *Linn.* As above. Stem noticeably transversely pseudo-septate. Bracts very short, scarious with ovate base.

Scattered throughout the Presidency in shallow water, but not common except in the Mallad tract of the Carnatic. (All warm regions).

38. **G. tegetiformis,** *Roxb.* As above. Stem trigonous at top, hardly septate when dry. Bracts leaf-like green, up to $\frac{3}{4}$ths of the inflorescence.

Rare. Khandala (Herb. St. Xav. Coll.) (E. Asian).

Note.—Both *C. tegetiformis* and *C. corymbosus*, Rottb., are given by Cooke as occurring at Kalyan (*fide*, Woodrowe). These two species are very imperfectly characterised, and are very probably forms of one species. Cooke doubts whether they both occur. I have placed the St. Xavier's College specimen in *tegetiformis* as the spikelets are pale, whereas the spikelets of *corymbosus* should be red. The bracts, however, are more than half the inflorescence.

H.—*Base of the stem an ovoid bulbil covered with a black, striated, splitting tunic.*

39. **C. bulbosus,** *Vahl.* Stolons very fine. Stem slender 4-12 inches. Leaves numerous. Umbels interrupted, *i.e.*, with an interval between the lowest bracts and the next one above it and so on, the displaced bracts bearing partial unbels in their axils. Rays short up to 2 inches. Spikelets elongate, narrow, reddish. Rhachilla with ovate persistent wings. Glumes appressed, obtuse.

Essentially a sand plant. Near the sea and inland in sand or very light soil, extending into the desert. The small bulbils are dug up and eaten in famines and even in ordinary years in N. Gujarat. (Baluchistan) Ceylon, Tropical Africa and N. Australia).

I.—*Rhizome short, Woody. Lateral shoots from the base of the stem immediately ascending. Stems tall, very thick at the base. Sheaths long, but blades very short or O. Umbel fairly large, compound. Glumes spreading (not imbricate) in fruit.*

40. **C. tegetum,** *Roxb.* As above. Spikelets $\frac{3}{4} \times \frac{1}{12}$ inch reddish.

A gregarious tall sedge (up to 4 ft. high or even more) often filling the margins of tanks and river-beds; occasional throughout the Presidency. Used in Bengal for mat-weaving. (Ceylon, Tropical Africa).

J.—*Stolons creeping underground, bearing tubers at intervals.*

41. **C. rotundus,** *Linn.* Stolons up to many yards long, bearing at intervals of 4-8 inches ovoid tubers, black outside, pale within, fragrant. Stems distant, one from each tuber, usually about 12 inches. Umbel small or large. Spikelets usually long (occasionally very long) narrow, normally reddish (pale even to white on clay soil, coal black on carboniferous soil, *e.g.*, station platform, Khandala.) Nut narrowly obovoid, trigonous, ashy black. Very variable owing to its wide range of habitat.

A superabundant and pestilential weed throughout the Presidency, often difficult to eradicate, especially in garden soil. (Most warm countries).

The tubers are roasted and eaten, and are pounded and the powder used in medicine or in the preparation of the fragrant sticks burned in Hindu houses and temples.

42. **C. tuberosus,** *Rottb.* As the last, but larger and stouter, with slenderer spikelets, and more distant, less imbricating glumes. Tubers less prominent, and a short rhizome present in addition to stolons.

Distribution uncertain. Probably scattered throughout the Presidency, in rather lonelier and wetter situations than the last. (Probably as the last).

Cooke remarks that this is a doubtful species, but perhaps the differences of habit noticeable in the field become less noticeable in Herbarium specimens.

43. **C. esculentus,** *Linn.* As No. 41, but with shorter and broader (usually paler) spikelets, and glumes striate-plicate. Often viviparous.

Occasional throughout the Presidency. Not uncommon in Bombay Island. (S. Europe, India, Africa, America).

I suspect that this species is an alien introduced into India.

K. *Tall stout marsh sedges, with compound umbels, bearing very long spikes with very numerous crowded short spikelets.*

Note.—*This very distinct group contains according to the F. B. I.* 6 *species, which are for the most part very imperfectly characterized.*

[**C. radiatus,** *Vahl.* Stems up to 3 feet. Umbels usually compound. Spikes of the ultimate clusters sessile, cylindric, very densely crowded with dull brown spikelets less than $\frac{1}{4}$ inch long. Distinguished from the next two by the sessile spikes.

Specimens in the Talbot Herbarium referred here are doubtfully of this species. Genuine specimens from Mt. Abu are in Herb. St. Xav. Coll. (North India, especially Bengal, E. Asia, Africa, America).]

44. **C. exaltatus,** *Retz.* Stems up to 6 ft., Umbel large. Spikes (at any rate some) peduncled, not so dense as the last and following spp. Spikelets very flattened, chestnut, $\frac{1}{5} \times \frac{1}{13}$ inches; secund.

A gregarious sedge of marshes. Throughout the Presidency. (Tropical and sub-tropical countries.)

(*b*) *Var* **dives,** *Cke.* Spikelets more turgid, divaricate, golden. (Distribution uncertain.)

(*c*) Spikelets longer up to $\frac{5}{8}$ inch or more, red gold, sinuately curved.

A very common form in the Presidency, especially the Mallad tract of the Carnatic.

45. **C. digitatus,** *Roxb.* As the last, but spikelets narrower, more attenuate and acute, not secund, less brightly coloured.

Not so common as the last (Tropics generally, but not specially Indo-Malayan).

2. **Mariscus,** *Vahl.*

Spikelets few—sometimes only one-flowered. Rhachilla disarticulating when mature above the 2 lowest (empty) glumes, leaving a knob or scar, on the rhachis. Nut trigonous. Styles 3. Habitat various. (Species 160, warm regions).

For remarks as to this genus, see the notes to the last genus.

Key to the genus :--

A.—*Stem short, stout, thickened at the base with coloured sheaths*	1. *M. bulbosus.*
B.—*Stem tall, or when short, then slender; spikelets v. narrow, not turgid, pale, bearing one, rarely two nuts.*	

(*Note.*—The species of this section are very imperfectly characterized. They are mostly considered by some authors to be varieties of the original *C. umbellatus,* Benth. They are as yet imperfectly known and studied in this Presidency and the account of them now given is merely tentative)

1. Stolons slender, creeping, stem slender, 10 inches Spikes few, short, sessile or v. shortly peduncled, in a simple contracted umbel or head. Spikelets somewhat curved..	2. *M. paniceus.*
2. The same but taller and with spikes rather longer and borne on short rays up to 2 inches	*M. paniceus.* var. *Roxburghiana.*
3. Rhizome rather short. Stem about 1 foot, fairly firm. Umbel simple of several spreading rays terminated by cylindric narrow spikes of crowded, straight, divaricate spikelets	3. *M. sieberianus.*

4. The same, but umbel compound, *i.e.*, primary rays bearing several digitately spreading spikes	*M. sieberianus.* var. *subcomposita.*
5. Taller and more robust. Umbel large, rays up to 7 inches. Spikes digitate on the rays. Spikelets fewer and more distant, subsecund, larger, ⅜ inch	4. *M. Konkanensis.*
C.—*Stem tall. Spikelets pale, turgid, bearing several nuts*	5. *M. albescens.*
D.—*Stem tall, robust. Umbel large, spreading. Spikelets innumerable in short globose spikes, very narrow almost filiform, golden red* ..	6. *M. microcephalus.*

1. **M. bulbosus,** *Cke. C. Clarkei,* Cooke. Stolons slender. Stem 3-8 inches, as clavis. Umbel simple with very short rays practically reduced to a head. Spikes about 6, ovoid, dense, pale, about $\frac{5}{8} \times \frac{5}{16}$ inches. Spikelets densely packed, spreading, broad-oblong.

Rare. Carnatic, (Herb. Talbot.) (India, W. Peninsula, Endemic).

2. **M. paniceus,** *Vahl.* Stolons slenders, creeping. Stems about 10 inches very slender. Bracts long. Inflorescence as clavis, usually only $\frac{1}{2}$-$\frac{3}{4}$ inch across.

A forest-plant, Ghat and Carnatic Mallad tracts. Flowers in the autumn. (Indian in the damper regions, Mauritius).

(*b*) *Var,* **Roxburghiana,** *Cke.* Larger, stems up to 2 ft. Umbel expanded with rays up to 2 inches.

I refer here specimens from Igatpuri and Salsette in Herb. St. X. Coll. In one of these the spikelets are darker in colour and the plant might with almost equal justification be referred to *M. cyperinus,* Vahl.

3. **M. sieberianus,** *Nees.* Rhizome short, stems 1-2½ ft. Umbel simple, with 5-12 straight rays teminated by cylindric dense spikes of divaricate, pale, straight spikelets.

I refer here specimens observed in the Carnatic, and one or two sheets in herbb. But I am not sure what the real line of division is between the last variety and this species. (Warm regions of the old world.)

[(*b*) *Var,* **subcomposita,** *Cke.* Umbel compound as clavis. Mentioned because it is likely to occur.]

4. **M. konkanensis,** *Cooke* (under *Cyperus*), F. B. P. II 874. *M. Sieberianus* Woodrow in J. B. N. H. S., Vol. 13 (1901) p. 431 (*not* of Nees). "*M. Sieberianus* var *subcomposita* (forma *gigantea*) sp. nova?" Clarke Ms. note on sheet Woodrow No. 34 in Herb Kew. Tall. Rhizome (when present) short, woody. Stems solitary or approximate on the rhizome, up to 30 inches high, stout, trigonous, striate, clothed far above the base with coloured striate sheaths, terminating in long, flat, many-nerved leaves. Inflorescence a large umbel subtended by leafy bracts. Rays up to 7 inches,

unequal. Spikes spikately arranged on the rays, or digitately arranged as secondary umbels, subtended by filiform bracteoles, 1-2 inches long, with many secund or divaricate linear-lanceolate and accuminate spikelets $\frac{5}{16}$ inch long. Glumes prominently multi-striate.

Central-parts of the Western Ghats and adjacent outlying hills, Khandalla, Purandhar, Singhar, (Herb. Agr. Coll.), also in a compound of the bungalow of Dr. Gammie at Kirkee, but possibly there introduced. (Not otherwise known.)

A distinct species with larger spikelets than the rest of the group.

5. **M. aibescens,** *Gaud. C. pennatus,* Lam. Perennial with woody root-stock, stems up to 3 ft. and leaves up to 4 ft. Leaves thick, many-veined and septato-punctate between the veins. Umbel large with stout rays and long spreading stout spikes of rather distant terete, turgid, pale, lanceolate spikelets, which bear 3-6 nuts.

Central parts of the Konkan and Ghats, app. rare, (Indo-Malayan, Tropical Africa and Polynezia).

6. **M. microcephalus** *Presl. C. dilutus,* Vahl. *C. spinulosus* Roxb. Tall and stout with thick leaves, Umbel umbrella shaped, as clavis. Spikelets bearing 4-14 nuts. Easily recognizable by its globes of golden-red, almost subulate spikelets.

In standing water throughout the Konkan, ghats and sub-ghat tracts Fairly common in the Mallad tract of the Carnatic. (Indo-Malayan, E. Asian, Mauritius).

3. **Kyllinga,** *Rottb.*

Small or medium herbs. Root system various. Inflorescence of 1-4 sessile dense spikes. Spikelets strongly laterally compressed, 1-2 flowered, if 1-flowered then with one bisexual and one male flower. Fruit a laterally compressed obvoid nut. (Species about 33. All warm regions except Europe).

The species of this genus, of which six are given by Clarke in the F. B. I. are imperfectly characterized. The wings to the keel of the glumes are variable in width and character.

Key to the genus :—

A. Keels of the fertile glumes not much winged in the upper half.
  1. Spikes 3 or 4, pure white, a low herb of dry ground .. .. 1. *K. triceps.*
  2. Spike 1 (rarely more) green or brownish rhizome elongate .. .. .. 2. *K. brevifolia.*
  3. Spike 1 pale green, rhizome thick, short, with quickly ascending stems, nuts ultimately black, a herb of marshes .. 3. *K. melanosperma.*

B. Keels of fertile glumes winged in the upper half.

1. Spike 1 (rarely more) green or discoloured, rhizome slender, creeping, bracts very long, flaccid, a herb of shady places .. .. 4. *K. monocaphala.*

1. **K. triceps,** *Rottb.* 2-8 inches high. Bracts spreading or deflexed, up to 3 inches, usually less, stiff. Heads pure white, usually one central and two or three smaller lateral, ovoid-cyindric, the central one usually $\frac{1}{4} \times \frac{3}{8}$ inch. Glumes with green keels and striate sides, not winged in the upper half.

A herb of open grass land, especially in the drier tracts. Matures in the mid-monsoon period. Throughout the Presidency. (African and Indo-Malayan).

2. **K. brevifolia,** *Rottb.* 4-18 inches high with a slender creeping rhizome. Bracts short, usually not more than 4 inches. Heads greenish, usually of only one spike, small, ovoid-globose; glumes with a narrow (usually slightly crested) wing in the lower half.

Distribution uncertain, but probably often confused with *K. monocephala.* (All warm regions except the Mediterranean.)

3. **K. melanosperma,** *Nees.* Rhizome very short, stout, horizontal, with ascending stems up to 20 inches. Head solitary, bee-hive-shaped, pale green. Bracts short broad, spreading, leaf-like, firm, sub-obtuse. Nuts at first white, afterwards black.

In the Presidency apparently confined to soft mud in marshes on the crest of the southern ghats. (Common on the Nilgiri Hills, Ceylon, Singapore, African and Indo-Malayan.)

4. **K. monocephala,** *Rottb.* 5-18 inches high with a very slender creeping rhizome bracts very long up to 8 inches, leaf-like, usually erect or spreading, not deflexed, flaccid. Heads green or dirty white, usually of only one spike, globose, $\frac{1}{4}$ inch. Glumes with a more or less prominent wing especially in the upper half, which may be either entire or lacerate, or sub-spinulose, sometimes speckled with minute red glands. Sides of glumes often smooth and speckled with brown, sometimes striate.

A flaccid herb of shady places, under trees and forest edges, especially in the wetter tracts. Throughout the Presidency except the extreme North. (Most warm regions).

(To be continued.)

A REVISION OF THE INDIAN SPECIES OF *ROTALA* AND *AMMANNIA*.

BY

E. BLATTER, S.J., AND PROF. F. HALLBERG.

Since C. B. Clarke described the Indian *Lythraceæ* in Hooker's Flora of British India (Vol. II, 1879) a number of new species have been described, but, unfortunately, the chief literature seems to be confined to a few botanical centres in Europe. Even those botanists who have written local floras during the last twenty years were apparently not aware of some important publications regarding the order *Lythraceæ*. The consequence is that many mistakes as to identification, description, and synonymy have crept into the more recent works on Indian botany. This is quite particularly the case with regard to the genus *Ammannia* (sens. ampl.). We are sure, everybody who has ever tried to name members of that genus must have experienced the great difficulties which arise, partly from the small size of the flowers, and partly from the want of well-defined species and adequate descriptions, not to mention evident mistakes that have been perpetuated in consequence of the combination of diagnoses which, originally, referred to distinct species. The fact, that many identifications in European as well as Indian herbaria are wrong or at least doubtful, has induced us to revise the genus as far as the Indian region is concerned. We must acknowledge our indebtedness to Koehne who monographed the *Lythraceæ* in 1903 (Engl. Pflanzenr. IV, 216). How far we agree with his treatment of the subject will be seen from our paper. We wish to thank the curators of the Herbaria of Calcutta, Madras, and Baroda, and Mr. Sedgwick for kindly putting their plant-material at our disposal. The number of specimens examined amounts to almost two thousand.

Bentham and Hooker divide their genus *Ammannia* into two sections and they call the division a very natural one. Clarke considers the two sections as two sub-genera and calls them respectively: *Rotala* and *Eu-Ammannia*. At the same time there have always been a number of botanists who distinguished the genera *Rotala* and *Ammannia*. We follow the latter. *Rotala* L. is characterized by septicidal capsules, whilst *Ammannia* has the capsules indehiscent, or bursting irregularly.

Rotala, L. (sens. ampl.).

Annual or more rarely perennial, water-or marsh-plants, quite glabrous. Leaves decussate or verticillate, rarely alternate, sessile or subsessile. Flowers small, solitary-axillary, or forming spikes or terminal racemes, rarely axillary umbels; bracteoles 2, rarely absent. Flowers 3-6-merous, actinomorphic, sometimes dimorphic. Calyx semiglobose, campanulate, urceolate-tubular, scarious-corolline or very rarely herbaceous, 3-6-lobed, cornua (appendages) present or absent, base of calyx often provided with a nectariferous ring. Petals persistent or more rarely caducous or absent. Stamens 1-6, episepalous. Ovary sessile or substipitate, incompletely 2-4-locular; ovules few or many and minute; style present or absent.—Capsule septicidally 2-4-valved, cartilaginous, the walls microscopically horizontally striate. Seeds very small.

KEY TO THE INDIAN SPECIES.

A.—Petals absent.
a. Bracteoles minute, scarious .. .. .. 1. *R. mexicana.*
b. Bracteoles 2-or more times longer than calyx, herbaceous .. .. 2. *R. occultiflora.*
B.—Petals present.
a. Leaves alternate .. .. 5. *R. floribunda.*
b. Leaves verticillate.
(*a*) Flowers spikate, flowering calyx campanulate .. .. 4. *R. Wallichii.*
(*b*) Flowers not spikate, fl. calyx suburceolate-tubular .. .. 3. *R. verticillaris.*
c. Leaves decussate.
(*a*) Macroscopic stipules present (as long as calyx) .. .. 11. *R. stipulata.*
(*b*) No macroscopic stipules.
I Petals deeply fimbriate .. .. .. 10. *R. fimbriata.*
II Petals entire or minutely erose-dentate.
1. Calyx almost truncate (capsule 4-valved) .. .. 9. *R. Ritchiei.*
2. Calyx distinctly lobed.
* Bracts absent, stamen 1 .. .. 6. *R. simpliciuscula.*
**Bracts 2, stamens 2-6.
† Stem with broad interrupted wings .. .. 12. *R. cordata.*
††Stem with narrow or continuous wings.
§ Bracteoles herbaceous, calyx suburceolate-tubular .. .. 15 *R. tenuis.*
§§ Bracteoles scarious, calyx broadly campanulate.
△Capsules always 2-valved, no cornua .. .. .. 13 *R. indica.*
△△Capsules normally not 2-valved.
○ Flowers spicate .. 14 *R. rotundifolia.*
○○Flowers not spicate.
□Capsules 3-4-valved on the same plant .. 8 *R. Fysonii.*
□Capsules 3-valved, very rarely 2-valved .. 7 *R. pentandra.*

Rotala mexicana, Cham & Schlecht in Linnaea, v (1830) 567; Koehne in Fl. Brasil. xiii, 2 (1877) 195, t. 39, fig. II, a, b, in Engl. Pflanzenr, iv, 216 (1903) 29.—*Ammannia pygmaea*, S. Kurz in Seem. Journ. Botany, v

(1867) 376, in Journ. As. Soc. Beng. xl, 2 (1871) 55 et xlvi, 2(1877) 85 ; Clarke in Hook. f. Fl. Brit. Ind. ii (1879) 568.—*Rotala verticillaris*, Hiern in Oliv. Fl. trop. Afr. ii (1871) 467, non L.—*Ammannia mexicana*, Baill. Hist. pl. Madag. atl. (1895) t. 363.

Creeping or erect, caespitose or tufted, submerged or with the tips emerged, or on wet ground ; branches filiform. Leaves 3-5-nate, or decussate, the submerged ones linear, 3-13 mm. long, scarcely 0·5-1 mm. broad, the emerged ones lanceolate or oblong, 3-4 mm. long, 1 mm. broad, all obtuse, or retuse-bimucronulate.

Flowers 4-5, rarely 3-or 6-merous, axillary, solitary, sessile, bracteoles whitish, as long as the calyx or shorter. Calyx 0·6-1 mm. long, in fr. semiglobose ; nectariferous scales present or absent, when present 2-5, minute or reaching half the length of the tube, sometimes bifid. Petals 0. Stamens 2-3. Ovary globose.

Capsule globose, 2-3-valved.

Distribution : Trop. Africa ; Asia : India, China, Japan, Philippines ; Australia ; America : Mexico, Guatemala, Cuba, Venezuela, Brazil.

The habit of the plant makes this species a very characteristic one. It varies to a certain extent, as we shall see below, but, in our opinion, not in such a way as to justify Koehne's division of the species into two subspecies with two varieties. Quite apart from many practical difficulties, which arise from this method of splitting up species, there are, in our case at least, so many intermediate forms passing into each other that it is impossible to mention any particular plant which does not show a tendency towards variation in some way or other.

We have carefully examined all the specimens from the Indian region which were at our disposal. We group them under two heads and point out the variations observed in each.

A : Capsule almost always 2-valved.

1. Densely caespitose in masses up to 5 cm. in diameter. Leaves decussate or ternate, reaching 3 mm., linear. Internodes generally much shorter than the leaves. Calyx minute, much extended by the rigidly spreading valves of the capsule, teeth 4, as long as the tube. Bracteoles shorter than the calyx.

Pegu in Lower Burma, Jan. (S. Kurz, No. 1967 !).

2. Stems erect, stout, with many stiff ascending branches, the latter densely leafy towards their tips and with very short internodes. Leaves decussate or ternate, reaching 3 mm. linear. Calyx with 4 teeth, about as long as the tube.

Central Provinces : Mahonadi, Dec. 1857 (Herb. Calc. !).

3. A minute plant with simple stem, 1 cm. high, with a few pairs of leaves.

Maubhoom, banks of streams, Jan. 1868 (O. Ball !).

4. Several ascending, fleshy stems radiating from the root about 5 cm. long, slightly branched. Leaves reaching 5 mm., the lower shorter than the internodes. Calyx-teeth 4, shorter than the wide tube.

Chota Nagpur : Parasnath, alt. 2,000′, Nov. 1874 (C. B. Clarke, No. 24856 !).

B : Capsule almost always 3-valved.

5. A slender plant, 5-6 cm. high. Internodes about as long as the decussate (rarely ternate) leaves which reach 6 mm. Stems slightly fleshy, tufted ; branches many, slender. Bracteoles about as long as calyx-tube. Calyx teeth 4-5, deltoid acute, almost as long as the tube. Capsule puberulous.

Shannoo, Oct. 1870 (Herb. Calc. !).

6. Habit somewhat like that of form 2, but the stems are shorter, probably prostrate. Calyx-teeth 4.

Bengal: Rajmahal Hills south of Salubganj, common among the ridges on the loamy moist paths, alt. ca. 500′, Oct. 1870 (S. Kurz!).

7. A minute terrestrial prostrate plant, growing in tufts 1 cm. in diameter, with very few flowers (generally the species flowers abundantly). Calyx 5-merous.

R. Bot. Garden, Calcutta, Aug. 1857 (S. Kurz.!).

8. A large form, reaching 10 cm. in height, with very long weak fleshy stems, densely interlaced and rooting at the nodes, evidently trailing in very shallow water. The trailing stems are leafless. Leaves on the erect parts reaching 5 mm., about as long as the internodes, decussate, rarely ternate. A few smaller oval leaves below. Flowers minute. Calyx-teeth 4.

N. Bengal: between Titalya and Silligoree, dried-up pools, Oct. 1868 (S. Kurz!).

9. Caespitose, growing in tufts 2-3 cm. in diameter. Leaves 2-3-nate. Calyx-teeth 4, longer than tube. A few 2-valved capsules observed.

N. Kanara: on garden-walks at Kadra, Oct. 1885 (Talbot, No. 1317!).

10. Similar to the last, but with weaker trailing stems.

Khasia Hills, alt. 2,000′ (J. D. Hooker and Thoms.!).

11. Very similar in habit to form 4, but the stems are much more numerous, stouter, and with contracted internodes, subsimple. Calyx-teeth 3-5, deltoid-acute, shorter than the tube. Capsules certainly 3-valved, which seems to have escaped Clarke's notice (see his remark in Hook. f. Fl. Brit. Ind. l. c.).

Chota Nagpur: Parasnath, alt. 1,000-4400′ (Clarke, No. 33811!).

12. A very densely tufted plant with erect stems, apparently growing on soft mud. Leaves reaching 3 mm. as long as the internodes. Calyx elongated, quadrangular, reddish, teeth 4-5, deltoid-acute, almost as long as the tube. At the bottom of the calyx-tube a few minute hypogynous scales. Bracteoles shorter than calyx.

Sikkim: Labhath, alt. 8,000′ (Ribu and Rhomoo, No. 2637!). Similar specimens from Upper Chindwin, Burma, collected by Meebold, Dec. 1907, Nos. 7569! 7808!

13. A small diffuse herb, lying flat on the ground in damp places. Stems reaching 7 cm, generally shorter, stout, fleshy, quadrangular, slightly 2-winged. Leaves opposite, reaching 3 mm, sparsely hairy on the upper side when old. Bracteoles as long as the calyx-tube. Calyx-teeth 4-5, greenish-white and fleshy when young, brown when old. Stamens 2 or 3; anthers brown. Stigma 3-lobed, green when young, brown when old. Capsule almost spherical, flattened on top, tubercled all over, largest tubercles on the sutures of the capsule. Seeds many, black, irregularly half-ellipsoidal, excavated on the flat side, shining.

Mt. Abu in Rajputana, Oct. 1916 (Blatt. and Hall. Nos. 3275! 3276!).

14. Stem submerged, quadrangular, weak, spongy. Leaves mostly 3-4 nate, sometimes opposite on the branches, reaching 7 mm. Calyx very small, teeth 4. The capsule has the appearance of a mulberry on account of the pressure of the seeds from within, pale green, translucent. Seeds twice as along as broad, trigonous with one curved and two plane surfaces, and with a minute beak at one end.

Mt. Abu: Salgaon Tank (Blatt. and Hall. Nos. 3280! 3281!).

15. Much like the last, but with 3-5-nate leaves, reaching 11 mm., narrower and more acute.

Bundelkund (Vicary!).

We have referred the last two specimens to this species although their habit is different from that of the other Indian specimens. Perhaps they come nearest to No. 17 below. The only alternative would have been to put them under *Rotala verticillaris*, L. But we have not observed petals, and the plants are, in addition, submerged and abundantly rooting at the nodes, a habit which has not been observed in *R. verticillaris.*

Decussate leaves are more common in Indian specimens than ternate ones, and the flowers have usually got 2 stamens. The necteriferous scales, if present, are very obscure.

We have compared two foreign specimens with the Indian material.

16. Mexico : State of Chihuahua, Sept. 1887 (Pringle, No. 1365 !). This is almost identical with No. 7, although the leaves are slightly longer and more acute.

17. North Korea, Aug. 1897 (Komarov, No. 1128 !). This is a somewhat larger plant than No. 4, but otherwise very much like it. The capsule, however, is 3-valved, and the leaves 2-4-nate.

2. *Rotala occultiflora*, Koehne in Engler's Bot. Jahrb. I (1880) 152, et in Engl. Pflanzenr, iv, 216 (1903) 30.

Plant erect or ascending, red-brown or green, 5-10 cm. long, simple or sparsely branched. Stem trigonous, corners rounded. Leaves 3-nate, the lowest opposite, linear, subauriculate at the base, 5-12 mm. long and 1 mm. broad, sessile, spreading, recurved.

Bracteoles 2, about 6 mm. long, 3 times as long as the capsule, enclosing the latter from two opposite sides, leaving the two other sides, free, meeting above the ovary and then spreading, green, thick leathery, lanceolate-acuminate, boat-shaped, generally bimucronulate. Flowers 5-merous; calyx membranous, teeth triangular-acuminate, a little shorter than the bell-shaped tube. Petals none. Stamens 3, anthers large. Ovary almost globose, slightly 3-lobed and a little depressed on top. Style very short ; stigma capitate.

Capsule 2-3-valved, broadly ovoid, not quite 2 mm. long. Seeds black, twice as long as broad, thickest in the middle, on one long side straight, flat, on the opposite long one rounded, ends rounded, surface minutely striate.

Habitat : Malabar, Konkan (Herb. Hook. f. and Th. !) ; Bombay Presidency : Bombay Island, at Sion (Blatt. and Hall. No. 3277 !) ; Salsette between Andheri and Marol in rice fields (Blatt. and Hall. No. 3303 !) : Igatpuri (Blatt. and Hall. No. 3304 ! 3279 !) ; Khandalla (Blatt. and Hall. No. 3278 !) ; N. Kanara : Yellapore, Oct. 1884, Nov. 1885 (Talbot. No. 1036 ! 1332 !) ; Mysore : Shi-moga, 2-3000′, Oct. 1908 (Meebold. No. 10281 !)

This is a very distinct species, and it is strange that it should have been overlooked both by C. B. Clarke and T. Cooke.

Koehne's var. *β. Leichhardtii* (in Engl. Bot. Jahrb, iv (1883) 387) cannot be retained as a distinct variety. The leaves of Talbot's specimen from N Kanara are linear, not plicate, with the base very slightly dilated and the midrib less thickened on the back. The bracteoles are linear-lanceolate flat, thin, obtuse. This plant must be considered as a transition form between the typical plant and Koehne's variety.

3. *Rotala verticillaris*, L. Mant. (1771) 175, excl. ic. Rheed. : DC. Prodr. III (1828) 76 ; Wight Ic. I (1838-40) t. 260, f. A ; Dalz. and Gibs, Bombay Flora (1861) 96 ; Khoene in Pflanzenr, iv, 216 (1903) 30.—*R. verticillata*, Roem. and Schult, Syst. I (1817) 521. *R. petaloidea,* Wight ex Steud. Nom. ed. 2, II (184) 474, sec. Ind. Kew.—*Ammannia rotala* Clarke in Hook f. Fl. Brit. Ind. II (1879) 567, non F. Muell. : Cooke Fl. Bomb. Pres. I (1903) 507.

Stems rooting, 5-15 cm. long, branching, angular in the upper part. Leaves 4-8-nate, linear, cuneate at the base, rarely oblanceolate or nearly oblong, 3-10 mm. long, 0·5—1, rarely 2·5 mm. broad, retuse or bimucronulate, the submerged ones (if present) narrower than the emerged ones.

Flowers 3-4-merous, axillary; bracteoles half as long as the calyx or shorter. Calyx 1·5-2 mm. long, suburceolate-tubular in flower. Petals as long as the lobes or slightly longer. Stamens inserted $\frac{1}{3}$ inside the tube, scarcely reaching the sinuses of the teeth. Style very short.

Capsule 3-4-valved, globose-ellipsoidal.

Habitat: Bombay Presidency: Konkan (Law); Halilal in Kanara (Talbot); Madras Presidency: Ambattur in the Chingulpet Distr., Feb. 1915 (Herb. Pres. College, Madras!). Ceylon (Herb. S. Kurz!). Seems to be rare.

In the specimens from Ambattur the stems are branching near the base. Stems and branches erect or ascending, rooting below, stout, flexuose, reaching 20 cm. Bracteoles minute. Flowers 3-merous. Calyx-teeth deltoid-acute, about $\frac{1}{4}$ of the length of the tube. Petals broadly obovate, rounded or retuse, 1-nerved. Stigma rather large, trigonous.

The Ceylon specimen has the stems erect, simple, or branched near the top, up to 10 cm. high. Leaves reaching 7 mm. Flowers 3-merous.

Distribution: India, Ceylon, Sunda Islands (after Miquel).

4. *Rotala wallichii*, Koehne in Engl. Bot. Jahrb. I (1880) 154, Engler's Pflanzenr, iv, 216 (1903) 31.—*Hydrolythrum Wallichii*, Hook. f. in Hook. Ic. Pl. xi, (3· ser I) (1885) 5, t. 1007; Clarke in Hook. f. Fl. Brit. Ind. II (1879) 572, except syn. *Welwitschiano.*— *Ammannia Wallichii*, S. Kurz in Journ. As. Soc. Beng. xlvi, 2 (1877) 84.

A glabrous aquatic herb. Stem about 20 cm. long, emerged part about 7-10 cm., rooting at the base; angular, sometimes branching. Leaves 4-10-nate, the submerged ones scarcely 0·5 mm. broad, bimucronulate, the emerged ones lanceolate or almost oblong, 2·5-4 mm. long, scarcely 1 mm. broad obtuse or bimucronate.

Spikes 2 cm. long or longer. Flowers 4-merous; pedicels about 0·75 mm. long; bracteoles $\frac{1}{3}$ the length of the calyx. Calyx 1·5 mm. long, broadly companulate, lobes half as long as the tube. Nectariferous scales 4, bilobed or bifid, united below into a ring. Petals as long as the calyx, broadly obovate-obtuse. Stamens inserted $\frac{1}{3}$ down the throat.

Style half as long as the ovary.

Capsule globose, 2-celled.

Habitat: Tenasserim: Tavoy (Wallich n. 9059, Helfer), Moulmein (ex Clarke).

Distribution: India, Java. (ex Clarke).

That *Hydrolythrum*, Hook. f, cannot be retained as a distinct genus seems to follow from a remark made by Clarke in Hook. f. Fl. Brit. Ind. II. 571: "A genus (*viz.* Hydrolythrum) only separable from Ammannia by habit."

5. *Rotala floribunda*, Koehne, in Engl. Bot. Jahrb. I (1880) 156, et in Engl. Pflanzenr, iv, 216 (1903) 32.—*Nimmonia floribunda*, Wight, in Madras Journ. Science, v (1837) 312, t. 20.—*Ameletia floribunda*, Wight, in Hook. Ic. Pl. new ser. v (1840) t. 826, in Ann. Sc. Nat. 2. ser. xi (184) 173, in Illustr. Ind. Bot. I (1840) 206, excl. tab. ibid. cit Dalz and Gibs. Bomb. Fl. (1861) 96.—*Ammannia floribunda*, C. B. Clarke in Hook. f. Fl. Brit. Ind. II (1879) 567.

Erect or shortly creeping at the base. Stem 10-25 cm., subterete, often much branched. Leaves alternate, narrow-oblong or linear, sessile, obtuse, base obtuse or cordate-amplectent, lower ones up to 5 cm. long, 1-4 mm. broad, upper ones much smaller, sometimes only 5 mm.

Racemes up to 1 cm. long, mostly dense on filiform peduncles; bracts lanceolate-linear; pedicel about 1 mm. long; bracteoles similar to the bracts, lanceolate, exceeding half the length of the calyx. Calyx 2-2·5 mm. long, campanulate; teeth 4, acute, without cornua. Petals 4, obovate, nearly twice the calyx-teeth, bright rose. In the short-styled flowers the stamens are half-exserted and the style almost as long as the lobes, in the long-styled flowers the stamens are half the length of the lobes and the style is three times as long as the ovary; stigma bilobed.

Capsule 2-valved, ellipsoid, much longer than broad. Seeds brown-yellow, elliptic, peltate.

Habitat: Bombay Presidency: On bare rocky ground on the highest Ghats, also below the Ghats at Shivapore (ex Dalz. and Gibs.); F. Western Ghats, 1624 m alt. (Delessert); Mahableshwar in large dense patches on the bare damp rocks (known as 'Mahableshwar heather'), Dec. 1890; Jan. 1891, Jan. 1892 (T. Cooke!); Mahableshwar to Pratapgad on wet rocks, Nov. 1902 (R. K. Bhide. No. 1212!); 'Malabar Concan' (Stocks, Law, etc., in Herb. Hook. f. and Th.!). Apparently endemic in the Bombay Presidency.

6. *Rotala simpliciuscula*, Koehne in Engl. Bot. Jahrb. i (1880) 159, et in Engl. Pflanzenr, iv, 216 (1903) 33.—*Ammannia simpliciuscula*, S. Kurz, in Journ. As. Soc., Beng. xl, 2 (1871) 54, et xlvi, 2 (1877) 85, (descr. erron.); Clarke in Hook. f. Fl. Brit. Ind. ii (1879) 568.

Decumbent herbs, creeping at the base and rooting, glabrous; erect part 1-4 cm. high. Stem 4-gonous, simple or sparingly branching, filiform. Leaves opposite, oblong or oblong-linear, 2·5-5 mm. long, 1·5-5 mm. broad, upper ones smaller, often obovate-oblong, obtuse or retuse, the lower ones narrowly oblong.

Flowers minute, scarlet, solitary, axillary, shortly pedicelled, in the axils of the upper leaves. Bracteoles 0. Calyx 3-4-lobed, hemispheric in fruit; lobes broadly triangular, as long as the tube; cornua 0 or very minute. Stamen 1. Petals extremely minute, linear. Style very small.

Capsule 3-valved, subglobose, twice as long as the calyx, red. Seeds black, subhemispheric, excavated on the plane face.

Habitat: Chittagong: on muddy ground around ponds and in inundated rice-fields, rare (Kurz!), 0-1,000′ (Hook. f. and Thoms. No. 23!); Khasia, 1850 (Herb. Calc.!).

7. *Rotala pentandra*, nov. comb.—*Ammannia densiflora*, Roth in Roem & Schult. Syst. iii (1818) 304; Nov. Spec. Ind. Or. (1821) 99, cum diagn. erronea; DC. Prodr. iii (1828) 79.—*Ammannia pentandra*, Roxb. Fl. Ind. i (1820) 448; DC. Prodr. iii (1828) 79; Wight and Arn. Prodr. i (1834) 305; Blume Mus. Bot. ii (1852) 134, t. 2, f. 46; Kurz in Journ. As. Soc., Beng. (1877) pt. ii, 85; C. B. Clarke in Hook. Fl. Brit. Ind. ii (1879) 568 (excl. var. fimbriata); Trimen Fl. Ceyl. ii 224; Duthie Fl. Upper Gang. Plain, i (1903) 350; Cooke Fl. Bomb. Pres. I (1903) 507.—*A. nana*, Roxb. Fl. Ind. i (1820) 427 sec. Wight, an recte?—*Sellowia uliginosa*, Roth Nov. Sp. Ind. Or. (1821) 156.— *Winterlia uliginosa*, Spreng. Syst. i (1825) 788.—*Ammannia rubra*, Ham. in D. Don Prodr. Fl. Nep. (1825) 220.—*Rotala roxburghiana*, Wight Ic. i (1840) t. 260 B, Illust. i (1840) 206.—*Ammannia leptopetala*, Blume Mus. Bot. ii (1852) 134.—*Tritheka pentandra* Miq. Fl. Ind. Bat. i (1855) 614, 1089.—*Ditheca densiflora*, Miq. l. c. 615.—*Ammannia littorea*, Miq. Prol. Fl. Jap. (1866-67) 149.—*Rotala illecebroides*, Koehne, in Engl. Bot. Jahrb. i (1880) 161, in Engl. Pflanzenr. iv, 216 (1903) 34.—*Rotala leptopetala*, Koehne, in Engl. Bot. Jahrb. iv (1883) 388, in Engl. Pflanzenr. l. c. 34.—*Rotala densiflora*, Koehne in Engl. Bot. Jahrb. i (1880) 164, iv (1883) 388, in Engl. Pflanzenr, l. c. 35 (cum subsp. et var.)—*Rotala alata*, Koehne, in Engl. Bot. Jahrb. i (1880) 171, et in Engl. Pflanzenr. iv, 216 (1903) 40.

Stem 5-45 cm. long, erect or creeping at the base and rooting, 4-gonous, often winged and with numerous 4-gonous opposite slender branches. Leaves decussate 2-32 mm. long, 1-9 mm. broad, broadly ovate or almost round, lanceolate or oblong, or linear-lanceolate, base cordate sub-cuneate or obtuse, apex subretuse or emarginate, obtuse, acuminate or acute.

Flowers sessile or nearly so in the axils of nearly horizontal floral leaves (bracts), 3-6-merous; bracteoles shorter or longer than the calyx. Calyx 1-2 mm. long, usually shortly campanulate, slightly longer than broad, teeth small, triangular, acute; accessory teeth as long as the primary ones, or shorter or longer, or absent. Petals subulate or obovate and subbilobed, or subrotund, narrowly acute or acute-bilobed, retuse or emarginate, often erose-denticulate, rarely oblong-elliptic-acute, half as long as, or shorter than, the calyx-lobes, rarely as long as the tube. Style half as long or as long as the ovary, or almost absent.

Capsule normally 3-valved, very rarely 2-valved, hemispheric or broadly $\frac{1}{2}$ ellipsoid.

There are at least five characters that might be used in classifying the numerous variations which fall under this species: (1) the presence or absence of uninterrupted wings on the stem, (2) the presence or absence of minute stipules on the margin of the leaf near the base, or in the axil itself (cf. Kurz's specimen from Bengal), (3) the size of the coruna, (4) the size and shape of the petals, (5) the presence or absence of minute tubercles on the valves of the capsule,—not to mention the habit of the plant, the shape of the leaves, and the number of the floral parts. We have spent many days in trying to bring order into this chaos of varying characters, but our attempts were futile. There might have been some hope of a final success, if some of the characters remained constant at least in the same specimen. You may examine twenty flowers of one specimen and find them agreeing in one particular point, and if you dissect one more flower you are sure to discover that it has developed in a different direction.

Habitat:	Bombay Island	.. Bombay Pres. ..	1917,	Blatter & Hallberg, No. 3312!
	Salsette ..	,, ,,	VIII, 1917,	Blatter & Hallberg, No. 3313! 3314!
	Khandala ..	,, ,,	VII, 1916,	Blatter & Hallberg, No. 3315!
	Igatpuri ..	,, ,,	I, 1917,	Blatter & Hallberg, No. 3316-24!
	Khandala, Duke's Nose.	,, ,,	IX, 1907,	Meebold, No. 8909!
	Lonavla ..	,, ,,	IX, 1907,	,, No. 15499!
	Panchgani ..	,, ,,	VIII, 1892,	Herb. T. Cooke!
	,, ..	,, ,,	X, 1908,	Blatter, No. 3325!
	Hulkop, Dharwar Dist.	,, ,,	XII, 1917,	Sedgwick, No. 3450!
	Ambewadi ..	,, ,,	X, 1907,	Patwardhan, No. 1184!
	Poladpur to Wada	,, ,,	X, 1890,	Kanitkar!
	N. Kanara ..	,, ,,	..	Talbot, Nos. 2! 586! 1034! 1066!
	Siddapore ..	,, ,,	XI, 1884,	Talbot, No. 1054!
	Malwan ..	,, ,,	..	Woodrow.
	Belgaum ..	,, ,,	..	Ritchie, No. 1750!
	Londa ..	,, ,,	..	Woodrow.
	On the Kala Naddi	,, ,,	..	Ritchie, No. 1185.
	Marmagoa	.. Goa ..	X, 1908,	Meebold, No. 10280!
	Aglatti	.. Mysore ..	II, 1908,	Meebold, No. 8235!
	Kulhutty Babab	.. S. India ..	X, 1908,	Meebold, No. 9757

Habitat:	Kollegal 2000′	Coimbatore	X .1905, Fischer, No. 660 !
		,,	Wight !
	Virarajendrapet Hill	Madras Pres	X 1915, Fyson !
	Tandigundi. Pulneys	,, ,,	III 1899, Herb. Pres. Coll. Madras, No. 2624 !
	Mt. Abu	Rajputana	X, 1916, Blatt. & Hall. No. 3327—3335 !
	Chenab River	Punjab	X, 1846, Herb. Calc. !
		N. W. Frontier.	Deane !
		N. W. Himalaya	Griffith !
		Nepal	Scully, No. 357 !
		,,	1821, Wallich, 2107 ! 2107A !
	W. Ranchi, 2,000′.	Chota Nagpur	XI. 1880, Gamble, No. 8765 !
	Lodhwa, 2,000′	,, ,,	X, 1883, Clarke, No. 34200 !
	Ranchi	,, ,,	IX, 1896, Mokim !
	Manbhum	,, ,,	IX, 1873, Clarke, No. 20632 !
	Goghat	Bengal	VIII, 1902, Herb. Calc. !
	Parasnath	Chota Nagpur	XI, 1868, Herb. Calc. !
	Siliguri	Bengal	Herb. Calc. !
		Lower Bengal	1867, Kurz !
		W. Bengal	X, 1866, Kurz !
	Rajapore	Bengal	III, 1867, Kurz !
	Khasia	Assam	Herb. Griffith, No. 2311 !
	Tipperah, 500-700′	Bengal	X, 1915, Delbarman, No. 733 !
		Assam	Masters !
		Ava	Wallich, No. 2102 !
		Arakan	X, 1869, Kurz !

Distribution: Africa: Sudan; Asia: Afghanistan, India to Australia.

8. *Rotala Fysonii* spec. nov.—Stem reaching 10 cm., erect, stout, or slender, quadrangular in the upper part, simple or branched. Branches ascending, filiform, quadrangular. Leaves decussate, generally reddish in colour, sessile, broadly ovate-cordate and half amplexicaul, reaching 4 × 3 mm., getting smaller upwards, acute, 1-nerved.

Flowers present in most of the axils, solitary, sessile. Bracteoles 2, subulate, whitish, not as long as calyx. Calyx a little more than 1 mm. long, widely campanulate, scarious; teeth 4, about as long as the tube, acutely triangular. Cornua 4, subulate, diverging, a little longer than the teeth. Petals 4, most minute. Stamens 4. Filaments inserted ½ way down the tube, but continuing inside the tube to its base, linear, flattened, and with a red spot just above their insertion. Anthers included. Style very short.

Capsule red, included in the calyx-tube, 4-3-valved, generally the former, red. Seeds ½ ellipsoidal, twice as long as broad, pale brown, one face flat, one curved, very finely longitudinally striate.

Habitat: Anamallay, alt. 2,000′, Dec. 1916 (P. F. Fyson, No. 3292 ! in Herb. Pres. Coll., Madras). Apparently rare and local.

This species comes near *R. pentandra*, but the habit is quite different. Besides, the flowers are always 4-merous and the capsule generally 4-valved.

9. *Rotala Ritchiei*, Koehne, in Engl. Bot. Jahrb. iv (1883) 386, Engl. Pflanzenr, iv, 216 (1903) 36—*Ammania Ritchiei*, C. B. Clarke in Hook. f. Fl. Brit. Ind. ii (1879) 566; Cooke Fl. Bomb. Pres. i (1903) 508.

Stem 15-30 cm. long, 4-gonous, creeping and rooting. Leaves opposite, the cauline 7-10 mm. long, about 3-4 mm. broad, sessile, elliptic-oblong, rounded at the apex, not conspicuously nerved.

Flowers solitary, axillary, pedicels up to 1 mm. long, bracteoles minute, subulate. Calyx about 2 mm. long, subtubular-campanulate, 4-gonous, at last narrowly cyathiform and terete, teeth 4, minute, the accessory teeth rather larger than the primary ones. Petals 4, minute, scarcely 1 mm. long, ovate or obovate, pale rose coloured. Stamens 4, inserted a little below the middle of the tube, reaching about ⅔ the length of the tube. Ovary narrowly ellipsoid, style scarcely longer than the broadly capitate stigma, as long as the anther.

Capsule 4-valved, ellipsoid, included in the calyx. Seeds elliptic, peltate, brown-yellow.

Habitat: Bombay Presidency: Belgaum, in rice fields, rooting amongst floating weeds, rare (Ritchie 1184).

10. *Rotala fimbriata*, Wight Ic. I (1840) t. 217; Ill. ii, 106; Koehne in Engl. Bot. Jahrb. i (1880) 166, et in Engl. Pflanzenr, iv, 216 (1903) 37.—*Ammannia Heyneana*, Wall. Cat. (1828) No. 2104.—*A. pentandra* var. *fimbriata*, C. B. Clarke in Hook. f. Fl. Brit. Ind. ii (1879) 569, *partim.*

Stems 16-53 cm. long, scarcely winged. Leaves 7-26 mm. long, 2-5 mm. broad, exstipulate, the lower ones sometimes linear, scarcely cordate, the upper cordate and often dilated at the base, lanceolate or oblong, obtuse.

Flowers 4-5-6-merous. Bracteoles very short, ovate, acute, slightly falcate, or half as long as the calyx, subulate. Calyx 2-2·5 mm. long, broadly campanulate. Petals large, deeply fimbriate-incised. Stamens 4-5-6, exserted. Filaments inserted near the base of the calyx-tube. Style 1-2 times as long as the ovary.

Capsule 3-valved, elongate-ellipsoid, large, scarious.

Habitat: W. India: Badami, Sept. 1911 (Bhide!), Sanvardem, Goa, Oct. 1908 (Meebold, No. 10282!); Mysore in paddy fields or on borders of tanks (Wight, No. 975!). Without locality (Wallich, No. 2104!).

11. *Rotala stipulata* sp. nov.—*Ammannia hexandra*, Wall. Cat. (1828) No. 2103.—*A. pentandra* var. *fimbriata*, Clarke in Hook. f. Fl. Brit. Ind. ii (1879) 569 (*partim*).—*Rotala hexandra*, Koehne in Engl. Bot. Jahrb. i (1880) 167, et in Engl. Pflanzenr.—IV, 216 (1903) 37.

Stems 20-35 cm. long or more, rooting below, very stout, sharply quadrangular, almost winged. Leaves 6-25 mm. long, 2-5 mm. broad, auriculate-cordate, amplectent, broadly linear, lanceolate, or oblong, obtuse or subemarginate. Stipules herbaceous, subulate, 2 mm. long, situated on the sharp corners of the stem.

Bracteoles deltoid-acute, scarious, slightly falcate, 1 mm. long or less, flowers 5-6-merous. Calyx 2 mm. long, very broadly companulate-subhemispheric. Teeth about ½ the length of the tube, deltoid-acute. Cornua 0. Petals about as long the calyx-teeth, rhomboid or obovate, erose-denticulate. Style as long as the ovary.

Capsule 4-(perhaps also 2-) valved, scarious, globose.

Habitat: Ava: near Segaen (Wallich, No. 2103!): Arracan: Kolodyne valley, wet pastures and swamps, frequent, Oct. 1869 (S. Kurz!).

Note.—In Wallich's specimen the flowers are 6-merous and the stamens far exserted, whilst Kurz's plant has 5-merous flowers with the stamens subexserted. This is the reason why we had to make a new species which includes both plants.

12. *Rotala cordata*, Koehne, in Engl. Bot. Jahrb. I (1880) 172, et in Engl. Pflanzenr, iv, 266 (1903) 40.

Stem creeping at the base, the erect part 28 cm. long, broadly 4-winged. Leaves 9-15 mm. long, 3-6 mm. broad, the floral ones even smaller, ovate-oblong or oblong, distinctly auricled at the base, with a minute stipule on the upper surface of each auricle. Below the auricles the base is suddenly contracted and runs down the stem as a broad wing, ending a little above the next node in an obtuse process.

Flowers 5-4-merous. Bracteoles ¼—⅓ the length of the calyx. Calyx 2-2·3 mm. long, broadly campanulate, teeth 5-4, as long as the tube; cornua absent; nectariferous ring adnate, reaching ¼ the length of the tube. Petals 1½ times the length of the calyx-teeth, persistent, broadly elliptic or obovate. Stamens inserted half way down the tube. Style as long as the ovary or ⅔ of it.

Capsule 3-valved, globose, minutely tubercled.

Habitat: Tropical region of Bengal (J. D. Hook and Th.!).

13. *Rotala indica* nov comb.—*Peplis indica*, Willd. Spec. Pl. ii (1799) 244.—*Ammannia nana*, Roxb. Fl. Ind. i (1820) 427 ex Clarke, non Wall.—*Ammannia peploides.* Spreng, Syst. i (1825) 444; Boiss. Fl. Or. ii (1872) 742; Clarke in Hook. Fl. Brit. Ind. ii (1879) 566; Duthie, Fl. Upper Gang. Plain, i (1903) 349; Cooke, Fl. Bomb. Pres. i (1903) 506.—*Ameletia indica* DC. in Mem. Soc. Gen. iii, 2 (1826) 82, t. 3, f. A; Prodr, iii (1828) 76; Wight, Ic. i (1838-40) t. 257 A; Blume, Mus. Bot. Lugd. Bat. ii (1852) 135, t. 47; Dalz. and Gibs. Bomb. Fl. (1861) 96.—*Ammannia polystachya*, Wall., Cat. (1828) n. 2094, 2094 a, b; Wight and Arn. Prodr. Fl. Ind. Or. (1834) 304.—*Ameletia elongata*, Blume, l. c. 135.—*Ameletia acutidens*, Miq., Fl. Ind. Bat. i (1855) 617.—*Ammannia subrotunda*, Wall. ex Kurz in Journ. As. Soc. Beng. iv, 2 (1871) 55, and xlvi, 2 (1877) 85; Clarke in Hook. f. Fl. Brit. Ind. ii (1879) 571.—*Rotala indica*, Koehne, in Engl. Bot. Jahrb. i (1880) 172, in Engl. Pflanzenr, iv, 216 (1903) 40.—*Rotala subrotunda*, Koehne, ll. cc. 174 and 41.

Stems 4-40 cm. long, decumbent at the base and rooting or erect, 4-gonous, rarely simple, mostly once or twice branched. Leaves 4-20 mm. long, 1·5-10 mm. broad, decussate, obovate or subspathulate-oblong or suborbicular, or narrowly oblong, the base cuneate or obtuse or cordate, the apex acute or very obtuse-mucronate, distinctly or obscurely cartiloginous-marginate, penninerved.

Flowers tetramerous, subsessile or with pedicels upto 2 mm. long, solitary in the axils of generally reduced leaves. Calyx 2-3 mm. long, narrowly or broadly companulate. Petals persistent, obovate or obovate-rotund, slightly acute or subemarginate at the apex. Stamens included or exserted. Style very variable, shorter or longer than the ovary.

Capsules 2-valved, narrowly ellipsoid or obovoid oblong.

R. indica is a most variable species. It can easily be distinguished from all other species, but the numerous variations are not such as to enable us to make distinct subspecies or varieties. We have tried to arrange the different forms in groups, and there is scarcely a morphological point that we did not make the basis of distinction, but without success. Even the distinction which Koehne pointed out in order to establish his two species *Rotala indica* and *R. subrotunda*, *viz.*, included and excluded anthers does not hold good. There are a great number of transition forms connecting the two extremes. We shall, therefore, confine ourselves to describing a number of forms. In doing so we wish to prevent the unnecessary multification of species in the future, on the one hand, and, on the other, to offer materials to those who are interested in the study of variations, the problems of distribution and evolution of plants. Many will agree with us when we say that the variations of plants in the tropics, and especially in India, have been too much neglected in the past.

Forma a. spicata.—Stem stout, 10-20 cm. high, quadrangular, not much branched, erect or ascending, rooting at the lower nodes. Leaves large, up to 15 × 8 mm., broadly obovate, attenuate at the base, penninerved, nerves prominent beneath, tip obtuse, or rounded. Flowers densely crowded in axillary spikes which generally are of the length of the leaves. Bracts elliptic-lanceolate, up to 5 × 2 mm. Otherwise as form *b. axillaris.*

This is the common Western India form; it has been found in the following localities: —

(1)	Condita, Salsette . .	Bombay Pres.	XII, 1916,	Blatt. & Hall. No.	3258!
(2)	Andheri, ,,	,, ,,	XII, 1916	,, ,, ,,	3259!
(3	Bhandup, ,,	,, ,,	XI, 1916	,, ,, ,,	3260!
(4)	Kalyan, Konkan . .	,, ,,	XI, 1916	,, ,, ,,	3261!
(5)	Penn, Colaba Dist.	,, ,,	II, 1917	,, ,, ,,	3262-3264!
(6)	Khandala, near tank	,, ,,	III, 1917	,, ,, ,,	3265-3266!
(7)	Igatpuri, rice fields.	,, ,,	I, 1917	,, ,, ,,	3267-3269!
(8)	Mt. Abu, 3,900' . .	Rajputana . .	XI, 1916	,, ,, ,,	3270!
(9)	Cambam, Madura Distr.	Madras Pres. .	V, 1917	,, ,, ,,	3271!
(10)	Surat	Bombay Pres.	. .	Kanitkar!	
(11)	Chikhalee, Surat . .	,, ,,	II, 1891,	Bhiwa!	
(12)	Castle Rock . .	,, ,,	X, 1902,	Gammie, No.	15720!

ad (5) No. 3264 has spikes about twice the length of the leaves.

ad (6) Spikes 2-4-times the length of the leaves; flowers less approximate.

ad (12) This specimen is intermediary between (2) of form *a.* and (2) under form *b.*, but has no axillary flowers.

Forma b. axillaris.—Stem 6 cm. high, sharply quadrangular, with several pairs of branches, rooting at the lower nodes. Internodes on stem and lower part of branches almost equal in length (5-10 mm). Leaves on main stem 12 × 5 mm., elliptic obovate, obtuse, those on the branches about 10 × 3 mm., elliptic or oblong, acute, attenuate at the base. Flowers remote, axillary, sessile, not on axillary spikes. Bracteoles subulate, not overtopping the calyx. Calyx narrowly quadrangular-campanulate, the four triangular acuminate teeth much shorter than the tube, erect, tube with 8 faint nerves, slightly striate. Petals minute, elliptic-acute, $\frac{1}{3}$ the length of the calyx-teeth, pink. Stamens reaching tips of petals, inserted near base of calyx-tube. Style about the length of capsule; stigma reaching tips of calyx-teeth. Capsule and seeds as usual.

Igatpuri (Bombay Pres.) Jan. 1917, (Blatt. and Hall. 3274!).

We have a specimen from the same locality (No. 3273!) on which axillary spikes with approximate flowers begin to appear, but the bracteoles are not much smaller than the leaves. Also strictly axillary flowers occur.

Forma c. elongata.—Stem stout, quadrangular, creeping on the ground, up to 50 cm. long, the top ascending. Most of the nodes rooting. Internodes about 25 mm. Primary branches slender, tufted, profusely flowering, much divided, about 15 cm. in length, leaves on the main stem caducous, broad-elliptic, up to 15mm. long, tip obtuse or rounded, on the branches smaller, about 7 × 2·5mm., elliptic, acute, narrowed into a petiole. They subtend either a flower (usually in the lower part of the branch), or a slender, up to 10 cm. long, subspicate secondary branch, which may again divide. Leaves on these branches similar to those of the primary ones, but getting smaller upwards, always subtending a flower, when not a anchlet. Flowers in slender spikes, generally remote; bracteoles 2, subulate, scarcely reaching the sinuses of the calyx-teeth. Calyx-teeth often only $\frac{1}{3}$ of the length of the tube, deltoid-acute; tube with 8 faint nerves. Petals minute, ovate-acute. Stamens inserted about half-way down the tube, but the filaments may be traced to the bottom of the tube. Anthers reaching tips of calyx-teeth. Style about as long as the ovary.

S. Andaman: Port Mouat, March 1893 (King's collector!), Cadellganj Hill Jungle, April 1895 (King's collector!); Car Nicobar, Johnson's Village Hill Jungle (King's collector!)

Forma d. conferta.—Stem stout, erect, subquadrangular, about 30 cm. high, with one similar branch half as high, and numerous short axillary, subspicate branchlets, densely crowded towards the tips of the stem and primary branch, both of which are almost naked in the lower part and with internodes about 2 cm. long. Leaves usually conspicuous, caducous, much larger in the lower part of the plant than in the upper, the lowest reaching 17×8 mm., broadly oblong, strongly nerved, obtuse, the upper comparatively narrow, subacute. Bracts on the spicate branchlets a little longer than the flowers, elliptic-acute; bracteoles subulate, reaching the sinuses of the calyx. Flowers larger than usual. Calyx-teeth $\frac{2}{3}$ the length of the tube, deltoid-acuminate. Tube with 8 very faint lines.

Petals large, as long as the teeth, broadly obovate-suborbicular, 1-nerved. Stamens exserted. Style twice the length of the ovary, far exserted.

Burma: Pegu-Yoma (S. Kurz, No. 1327!).

Forma e. subrotunda.—Stem creeping, rooting at the nodes below, sending out erect, slender, sharply quadrangular branches, 10-15 cm. high. Leaves decussate, sessile, suborbicular, rounded at the tip, those on the stem 8×6 mm., subtending a primary branch; this has slightly smaller leaves, which subtend a secondary branch, terminating in a small dense raceme. The leaves get slightly narrower upwards, are sometimes ovate-elliptic, subacute or minutely mucronulate. Bracts lanceolate or oblanceolate, obtuse about as long as the flower. Rhachis of raceme very slender, naked below, sometimes slightly branched, 5-20 mm. long, many-flowered. Pedicels capillary, lowest sometimes reaching 2 mm., distant, upper shorter, approximate, all paired. Bracteoles 2, situated on the pedicels immediately below the calyx, minute, subulate, reaching about $\frac{1}{2}$ way up the calyx-tube. Calyx-tube narrow, broadened upwards; teeth 4, deltoid-acute, slightly shorter than the tube, erect. Petals 4, slightly longer than the calyx-teeth, obovate-spathulate, apex rounded. Stamens 4, fixed about $\frac{1}{2}$ way down the tube; filaments long, slightly curved; anthers exserted. Style twice as long as the ovary, far exserted; stigma capitellate.

(1)	Myitkyina Dist.	.. Upper Burma.		II, 1909, E. M. Buchanan!
(2)	Segain in Ava	.. ,,	..	X, 1826, Wallich, 2096!
(3)	Mandalay ..	.. ,,	,,	I, 1868, Anderson!
(4)	,, ..	.. ,,	..	.. ,, Anderson!
(5)	Bhamo ..	.. ,,	,,	.... Anderson!
(6)	Kha-tha ..	.. ,,	,,	I, 1868, Anderson!
(7)	Monywa ..	.. ,,	,,	XII, 1907, Meebold, No. 7928!
(8)	Tamu ..	.. ,,	,,	XII, 1907, Meebold, No. 7602!
(9)	Laireen ..	.. Manipur	..	IV, 1882, Watt, No. 7312!

ad (1). Type for the above description.

ad (2). Type for Wallich's *Ammannia subrotunda*, described by Kurz (1). There are three specimens on the sheet, one of which comes very near our form, except for the very short pedicels. The other two specimens are much poorer in flowers and richer in leaves.

ad (3). Near (1), but with longer internodes and larger leaves; there is a tendency towards the formation of panicles, and the pedicels are short.

ad (4). Like (1), but with short pedicels.

ad (5). A luxuriant robust specimen with many stems from the root less conspicuous petals and shorter pedicels than (1).

ad (6) A specimen more like (2), with longer leaf-like bracts and fewer flowers.

ad (7). Very similar to the two extremes on Wallich's sheet.

ad (8). Very close to the intermediary specimen on Wallich's sheet erect.

ad (9). The only specimens obtained outside Burma. They come close to (8), but are smaller.

Forma f. macrandra.—Stem ascending, rooting at the lower nodes, branched, subquadrangular. Leaves broadly obovate, upto 15×6 mm., rounded at the apex. Flowers in axillary, sometimes branched spikes, which are longer than the leaf, cylindrical, dense. Bracts as long as the flower, elliptic, subacute. Bracteoles 2, only half as long as the calyx-tube. Calyx-tube with the usual 8 very fine lines, narrow; teeth less than half the length of the tube, deltoid-acuminate. Petals red, obovate, as long as the calyx-teeth Stamens inserted near base of tube, far exserted. Style twice the length of the ovary, far exserted. Stigma capitellate.

Upper Burma: Zemyn village in Minbu Dist., Jan. 1903 (Shaik Mokim, No. 1123!).

Forma g. philippinensis.—Stem 6-25 cm. high, sparingly branched. Internodes 1-2 cm. long. Leaves elliptic, up to 12 × 5 mm., with strong midrib, minutely mucronulate. Flowers on axillary branchlets, generally shorter than the leaves, crowded among reduced opposite floral leaves (bracts) which often conceal the flowers and are about twice their length. These bracts are generally deflexed. Bracteoles 2, half the length of the calyx. Calyx long and narrow, teeth nearly or quite as long as the tube, deltoid-acuminate, tube with 8 very faint nerves Petals minute, oblong or elliptic, with the tip obtuse. Stamens subincluded. Filaments very slender, inserted low in the tube. Style half as long as the tube.

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(1) S. Kurz (" On some new or imperfectly known Indian plants " in Jour. As. Soc., Beng., XL, II (1871) 55) gives the following description of a plant which he calls *Ammannia subrotunda*, Wall : " Leaves sessile, almost orbicular, penninerved; flowers on slender short pedicels, forming shorter or longer slender racemes."—Clarke (Hook. f. Fl. Brit. Ind. ii (1879) 569) copies Kurz's description, retaining the name, and adds. that he has not seen the plant. He does not give the other reference to Kurz (" Contributions towards a knowledge of the Burmese Flora " in Jour. A. S. Beng., xlvi, ii 1877) 84), in which Kurz gives an almost identical description of the plant, adding however : " Wall. Cat. 2096. Hab. Ava. from Segain and Mandalay northwards in the Irrawady valley.—Fl. Fr. Jan."—We find in Herb. Calc. a sheet bearing the label " 2096 *Ammannia subrotunda*, Wall." in Wallich's own handwriting. Below is the following note by G. Watt. dated 1882 : " I can see no difference between the above, and they should, in my opinion, be regarded as in Fl. Brit. Ind. as forming a variety at most of the common *A. peploides*. Since the name *A. subrotunda* is not published by Wallich, I presume that the above label is Kurz's authority for that name." As a matter of fact, Clarke gives '*A. latifolia*', Wall. Cat. 2096, partly, under *A. peploides*, Spreng. The same reference, however, occurs also under *A. rotundifolia*. Ham. in Fl. Brit. Ind.

Now '*latifolia*' is written in pencil above '*subrotunda*', probably by Wallich himself. There is another label on the sheet in question, also in Wallich's hand, which seems to be the original one, since the locality and date are given. It bears the name '*A. rotundifolia*. Buch.'

The history of the name '*A. subrotunda*, Wall.' is probably this : Wallich first thought the plant was *A. rotundifolia*, later, that it was a new species and wrote on one of the sheets bearing the number 2096 the name *A. subrotunda* For some reason or other he found the name unsuitable and changed it into *A. latifolia* writing down the name on all the sheets. The first sheet was the one in Herb. Calc. seen by Kurz who retained the name *A. subrotunda*, Wall. The other sheets were studied by Clarke who put them under *A. pepl.* and *A. rotundifolia*, respectively. This is the reason why Clarke does not mention Wall. Cat 2096 as referring to *A. subrotunda*. He must, however, have seen Kurz's second note, since he gives Ava as locality.

(1) Manila	Luzon	XII, 1592, Loher, No. 2159!
(2) Province of Rizal	„	XII, 1892, Reillo, No. 19157!
(3) Prov. of Cavite	„	II, 1913, Robinson, No. 18268!
(4) Prov. of Rizal	„	V, 1907, Ramos, No. 2692!

ad (1) Specimens small, unbranched, with larger leaves and short axillary spikelets.

ad (2) Specimens large, sparingly branched from the base, and with a few slender branches higher up. Leaves and spikes similar to (1).

ad (3) Specimens small, with many erect stout stems from the base, with a tufted habit. Leaves smaller, as are the bracts, and the flowers, consequently, more conspicuous.

ad (4) Similar to the last, but larger and not branched from the base, with spikes longer than the leaves.

Forma h. koreana —Stems one or two from the root, stout, reaching 10 cm., quadrangular, apparently fleshy. Lower internodes 12 mm. upper much shorter. Leaves small, obovate and up to 10 × 3 mm., or suborbicular and up to 5 × 4 mm. leathery, with narrow white cartilaginous margins, tip rounded or retuse. Flowers axillary, solitary, sessile, or sometimes 2-3 clustered in the axils of greatly reduced leaves, forming thus a condensed spike. Calyx large, up to 3 mm., wider in fruit than is usually the case; teeth deltoid-acute, about half the length of the tube, which has 8 very faint nerves. Petals minute, broadly ovate, acute Stamens included, inserted near base of tube. Style equal in length to ovary, half as long as the capsule. Stigma subincluded, capitate.

N. Korea: Jalu river near Chudshu-ulei, Aug. 1897 (Komorov, No. 1124!).

We add the localities of a number of specimens from all over India and of a few others which we cannot include in any of the above forms. Neither can we detect any distinct forms amongst them, as they pass insensibly into each other. The extremes, however, differ so much from each other that, if examined without the intermediate forms, they might easily be taken for different species. It appears, on the whole, that the flowers become more distant and the axillary branches more slender, the further east we go. But there are exceptions to this rule.

(1)	Bombay Pres.		Dalzell!
(2) Belcherri	N. Kanara	XII, 1884,	Talbot, No. 1116!
(3) Mahanadi	C. Provinces	XII, 1857,	Herb. Calc.!
(4) Burhanpur	„ „		Vicary!
(5)	Punjab-Bengal.		T. Thomson!
(6) Parasnath	Chota Nagpur.		Prain!
(7) „	„ „	XII, 1866,	S. Kurz!
(8) „	„ „	„ „	„
(9) Bettiah	Bengal	1894,	P. Hieronymus!
(10)	Sikkim	II, 1867,	T. Anderson!
(11)	„	II, 1911,	Ribu and Rhomoo, No. 4954!

(12)		Chota Nagpur.		J. J. Wood, No. 1032 !
(13)	Lohardaga, 1,000′	,, ,,	XII, 1874,	C. B. Clarke, No. 25128 !
(14)	,, 2,000′	,, ,,	XI, 1882,	,, ,, ,, 34092 !
(15)	Manipur	Assam	XII, 1813,	Wallich, No. 2093 !
(16)		Nepal	1821,	,, ,, 2094 A
(17)		,,		,, ,, 2094 B !
(18)	Naga Hills, 3,000′	Manipur	XII, 1907,	Meebold, No. 7475 !
(19)		Assam	1842,	Jenkins !
(20)		Yunan	1875,	Anderson !
(21)	Shanmura, 600-900′	Tipperah	XII, 1914,	P. M. Deblarman, No. 394 !
(22)	Kah-tha	Burma	I. 1868,	Anderson !
(23)	Bhamo	,,		,,
(24)		Upper Burma.		Collet !
(25)	Pegu	Burma		S. Kurz, No. 1327 !
(26)	Ahyab, Arracan	Lower Burma.		S. Kurz !
(27)	Pegu Yoma	,, ,,		,, ,,
(28)	Tonkyerhat, Pegu	,, ,,		,, ,,
(29)	Rangoon	,, ,,	I, 1857,	Cleghorn !
(30)	Hulkop (Dharwar) 2,000′	Bombay Pres.	XII, 1917,	L. J. Sedgwick !
(31)		Java		Horsfield !
(32)	Chiengmai	Siam	I, 1911,	A. F. G. Kerr, No. 1647 !
(33)	Guiting Kabok	Perlis	III, 1910,	Herb. Calc., No. 15034 !

ad (1). Comes very close to *forma spicata.*

ad (2). A small plant with a pyramidal habit, due to the greater length of the lower branches. Bracteoles a little shorter than calyx, whose teeth are a little shorter than its tube. Stigma reaching tips of calyx-teeth; stamens subincluded. Petals $\frac{1}{3}$ the length of the calyx-teeth, ovate-acute.

ad (2). and (3). Very close to *forma spicata.*

ad (5). Three sheets. More or less similar to *forma spicata,* one almost identical with No. 8 below.

ad (6). Two sheets. Specimens with slightly elongate lax spikes. Bracteoles almost as long as calyx. Calyx-teeth about as long as tube. Stamens included, stigma exserted.

ad (7). Suberect, lower branches long. Spikes not very dense. Stamens subincluded, style slightly exserted.

ad (8). Extensive. Stem ascending, much-branched. Spikes dense, short. Stamens and style slightly exserted.

ad (9). "Ad confines Nepal, in paludibus." Erect, more or less branched, sometimes of almost spherical growth. Flowers like those of the next.

ad (10). Large, creeping, probably growing flat on the ground, much branched. Spikes not very dense. Bracteoles as long as calyx-tube. Calyx-teeth only $\frac{1}{3}$ the length of the tube. Petals $\frac{1}{2}$ as long as the calyx-teeth. Stamens subincluded, style as long as capsule, slightly exserted.

ad (11). Very much like the last.

ad (12). Much branched, but not compact. Spikes short, rather lax. Petals obovate-acute, $\frac{1}{2}$ length of calyx-teeth. Stamens subincluded, stigma exserted.

ad (13). Stem creeping, rooting. Spikes short, dense, very unlike those of the next specimen. Petals ovate-acute, $\frac{1}{2}$ as long as calyx-teeth.

ad (14). Stem creeping, rooting, sending up many stout branches, profusely flowering. Spikes lax, bracteoles shorter than calyx. Petals small, anthers subincluded.

ad (15-17) and (19). Rugged plants with more or less densely crowded flowers and generally lanceolate reflexed bracts. Stamens inserted near base of calyx-tube. Petals small. Anthers and stigma subincluded.

ad (18). A small erect plant. Spikes rather lax, about the length of the leaves. Bracts small. Calyx broadly campanulate. Style about as long as the ovoid capsule.

ad (20). Intermediate between forma *a*. and forma *b*. Stems several from the root, profusely flowering. There is an abrupt change from the large leaves to the bracts proper. Bracteoles as long as the broadly campanulate calyx. Anthers and stigma subexserted. Style only ½ as long as the capsule. Petals small.

ad (21). Stem creeping and rooting, long and stout, sending up slender branches along its whole length. Leaves on stem up to 20 × 10 mm. (the largest observed in this species), broadly obovate. Leaves on the branches gradually passing into bracts. Petals minute. Stamens and style subincluded.

ad (22). Erect or ascending, rooting at the base. Bracteoles hardly as long as the calyx-tube. Petals small. Style shorter than capsule.

ad (23). Compact. Branches long, again divided. Bracteoles as long as the broadly campanulate calyx. Petals minute. Stamens included.

ad (24). A tall slender plant, 40 cm. high, with a poor rugged appearance. Branches reaching 5 cm., almost horizontal. Flowers in axillary clusters or very short spikes. Calyx long and narrow. Bracteoles as long as the calyx-tube. Calyx-teeth ½ as long as the tube. Anthers and stigma reaching tips of calyx-teeth. Petals large.

ad (25). Creeping, tip of stem ascending, much branched. Petals very small, suborbicular. Style shorter than capsule.

ad (26). Erect. Upper leaves subacute. Spikes short, adpressed, dense. Flowers small, concealed by crowded adpressed bracts. Bracteoles twice the length of the calyx.

ad (27). A slender weak plant, with broadly obovate leaves, short lax spikes, large calyx, its teeth almost as long as the tube. Petals minute.

Stamens included. Style slightly exserted.

ad (28). Much-branched. Branches long, ascending, flexuose. Leaves ovate-oblong, acute. Spikes lax; bracts rather large. Calyx-tube slender, teeth ½ its length. Petals as long as the calyx-teeth, suborbicular. Stamens exserted. Style twice the length of the capsule, far exserted.

ad (29). Not unlike forma *c*. but with much shorter spikes.

ad (30). An erect plant of very regular growth, tinged with pink. Stem simple, except for the axillary spikes, which are shorter or longer than the leaves. Calyx pink, narrow, teeth as long as tube; bracteoles longer than calyx. Petals pink, ⅓ length of calyx-teeth, acute, 1-nerved. Stamens and style subincluded.

ad (31). Spikes not dense, reaching 4 cm. Bracteoles ½ the length of the calyx. Calyx-teeth half the length of the tube. Stamens included, stigma exserted.

ad (32). Very unlike the other specimens from the Philippines under forma *g*. and more similar to certain Burmese specimens.

Axillary branches sometimes exceeding 30 mm., very slender and with long internodes, the lowest up to 8 mm. Flowers in the axils of reduced leaves.

ad (23). Much like forma *g*. Bracteoles as long as calyx-tube. Calyx teeth acuminate ; stigma reaching their tips. Style shorter than ovary. Petals half as long as the calyx-teeth, ovate acute.

ad (34) Spikes reaching 25 mm., not dense. Bracteoles shorter than calyx. Petals minute. Stamens subincluded. Style as long as capsule. Stigma almost reaching tips of calyx-teeth.

Distribution of the species : Tanscaucasus, Afghanistan, India, Ceylon, Java, Tonkin, China, Philippines, Japan.

14. *Rotala rotundifolia* nov. comb.—*Ammania rotundifolia*, Roxb. Fl. Ind. 1 (1820) 446 ; DC. Prodr. iii (1828) 79 ; Wight and Arn. Prodr. i (1834) 306; Benth. Fl. Hongk. (1861) III ; Clarke in Hook. f. Fl. Brit. Ind. ii (1879) 566 ; Duthie Fl. Upper Gang. Plain (1903) 349 ; Cooke, Fl. Bomb. Pres. i (1903) 508 —*Ameletia rotundifolia*, Wight Ic. i (1840) t. 258 ; Dalz. and Gibs., Bomb. Fl. (1861) 96.—*Ammannia subspicata*, Benth. in Hook. Lond. Journ. Bot. i (1842) 484.—*Ameletia subspicata*, Benth. in Hook. Kew Journ. Bot. iv (1842) 81.—*Rotala rotundifolia*, Koehne, in Engl. Bot. Jahrb. i (1880) 175, in Engl. Pflanzenr., iv, 216 (1903) 41.—*Rotala macrandra*, Koehne, in Engl. Bot. Jahrb. i (1880) 176, in Engl. Pflanzenr. iv, 216 (1903) 42.

Stems rooting and creeping extensively, erect part together with the stem-like branches reaching 6-38 cm. Leaves decussate, 3-20 mm. long, 2·5-14 mm. broad, sessile or shortly petioled, rotund or obovate, rarely oblong, obtuse at the apex, subacute or subcordate at the base, penninerved.

Racemes dense, pedunculate, often three, sometimes one only, sometimes panicled ; pedicels scarcely 1 mm. long ; bracts herbaceous or scarious, ovate or oblong, bracteiform ; bracteoles subherbaceous or scarious, minute. Flowers typically 4-merous. Calyx 1·5-2 mm. long and as broad, campanulate ; teeth 4, acute, triangular, without interjected folds. Stamens included or exserted. Petals 4, obovate, twice the length of the calyx-teeth, bright rose. Ovary globose, style half as long as the ovary.

Capsule 4-3-valved, ellipsoid, a little longer than broad. Seeds brown-yellow, ellipsoid, peltate.

We have united *R. macandra*, Koehne, with *R. rotundifolia*. Koehne founded his species on the greater length of the stamens, a character which is not at all constant in his subsection *Mirkooa*.

Habitat : Sawantwadee	Bombay Pres.	XI, 1891	Herb. T. Cooke ! Kanitkar.
Malwan	,, ,,		Woodrow.
Belgaum	,, ,,		Ritchie, No. 1069.
Castle Rock	,, ,,	IV, 1909	Bhide !
Londa	,, ,,	X, 1910	Bhide !
Poona	,, ,,		Herb. Ec. Bot., Poona !
Dharwar District 2,000′.	,, ,,	III. 1917	Sedgwick, No. 2396 !
‘Malabar Concan’.	,, ,,		Stocks, Law, etc. !
	,, ,,		Dalzell !
	,, ,,		Gibson !
Ganjam	Madras Pres.	I, 1900	C. A. Barber, No. 1223 !
Kodaikanal	,, ,,	VI, 1911	Fyson, No. 1239 !

Habitat :

Ootacamund, garden.	Madras Pres.	V, 1907,	Gammie!
,,	,,	VIII, 1878,	King!
Kakeri	,,	XII, 1906,	Herb., St. Xavier's College, Bombay, No. 3306!
Neilgheries			Herb. Ec. Bot., Poona!
Ananthapura	Mysore	X, 1908,	Meebold, No. 10284!
Gorna	C. India	IV, 1867,	King, No. 25!
	Punjab		Thomson!
Kangra, 4,000-5,000′.	,,		Herb. Calc.!
Pathankhot	,,	III, 1902,	Watt, No. 15208!
Hoshiarpur Dist.	,,	III, 1902,	Watt, No. 15577!
Hoshiarpur	,,		Aitchison!
	N. W. India		Herb. Royle!
Chamba	N. W. Himalya.	VI, 1864,	Brandis, No. 4295!
Jaunsar	U. Prov.	V, 1891,	Gamble!
Dhoon	,,		Vicary!
Thadgor, 3,000′	N. W. Prov.	V, 1896,	Gamble, No. 23029!
Parolha, 3,000′	,, ,,	VI, 1893,	Gamble, No. 24402!
Gharwal	U. Prov.		King!
Dehra Dun	,,		Herb. Calc.!
Almora, 5,500′	Kumaon		Strachey and Winterb., No. 1!
Kheri	Oudh	IV, 1898,	Herb. Calc., No. 21575!
Dehra Dun	U. Prov.	IV, 1881,	Gollan!
	Kumaon		Wallich, No. 2095 E!
5,000′	Kumaon		Anderson!
	Nepal		P. Hieronymus, No. 290!
	,,	1820,	Wallich, No. 2095 B!
	Sikkim	II, 1867,	Anderson!
Golma		IV, 1914,	Herb. Calc.!
	,,		Gammie!
Rumbhughora	,,	II, 1908,	Ribu
	Bengal		J. D. Hook, and T.!
Darjeeling Dist.	,,	IV, 1908,	Smith!
Between Matigeru and Naxalbari.	Darjeeling Dist.	I, 1911,	Burkill!
Kurseong	,,	V, 1915,	Modder, No. 131!
Monghyr	Bengal		Wallich, 2095 A!
Manbhoom	,,		Ball!
	N. Bengal	X, 1868,	S. Kurz!
Baragaon	Chota Nagpur.	V, 1878,	Wood!
Pothuria, 1,000′	,, ,,	1886,	Campbell in Herb. Watt., No. 8276!
Parasnath	,, ,,	III, 1887,	Campbell, No. 27!
Tingale Bam Junga.	Assam	III, 1899,	Herb. Calc., No. 800!
	,,		Jenkins!

Habitat:	Brahmaputra Plains.	Lower Assam		Herb., S. Kurz, No. 27!
	Plains	Assam		Lister!
	Shillong	,,	V,	1893, Herb. Calc.!
	Banks of Brahmaputra.	,,	II,	1896, Herb. Calc., No. 46!
	Golaghat, 300′	,,	III,	1896, Herb. Calc., No. 51!
	Sibsagar	,,	IV,	1895, Herb. Calc., No. 10495!
	Sibsagar	,,	II,	1845, Herb. Calc., No. 1246!
	Garo Hills, Kamrup Dist.	,,	I,	1903, Marten!
	Manipur Valley Noung Shong.	Manipur	II,	1882, Watt., No. 5835!
	Khong Valley	,,	IV,	1882, Watt., No. 6297!
	Kanglatongbi, 3,000′.	,,	II,	1906, Meebold, No. 5506!
	Kohima, 3,000-6,000′.	Naga Hills	IV,	1886, Prain!
	Kohima, 5,000′	,,	II,	1882, Collet, No. 131!
	Choorapunji, 4,000′	Khasia Hill	VI,	1911, Burkill & Banerjee, No. 170!
	Choorapunji, 5,000′	,, ,,	VII,	1878, Gallatly, No. 418!
	Bhamo	Burma	II,	1868, Anderson!
	Poonshee	,,	III,	1868, Anderson!
	S. Shan States	,,		1894, Abdul Khalil!
	Ruby Mines	Upper Burma	III,	1892, Abdul Huk, No. 148! 149!
	Kachin Hills	,, ,,	V,	1898, Shaik Mokim!
	S. Shan States	Burma	XII,	1909, Mac Gregor, No. 1211!
	Bhamo	,,	V-VI,	1911, Sidney Toppin, No. 3083!
	Yunnan, 4,500-5,000′.	China		1897, Henry, No. 9355!
	Yunnan	,,	IV,	1902, Herb. Calc.!
	Hupeh Prov.	Central China.		Henry, No. 220!
		N. W. Formosa.		1862, Swinhoe.

In some specimens collected by Fyson in S. India (No. 1475! 4371!) some or all the leaves are linear to linear oblong, attaining 10×1 mm., obtuse or retuse, the nerves anastomosing. As the parts of the plant, on which these leaves occur, show no flowers, we conclude that they were submerged in analogy to what takes place in *Rotala tenuis* under similar circumstances.

15. *Rotala tenuis*, Koehne, in Engl. Bot. Jahrb. i (1880) 177, in Engl. Pflanzenr, iv, 216 (1903) 42.—*Ameletia tenuis*, Wight, Ic. i (1840) t. 257 B; Dalz. and Gibs., Bombay Fl. (1861) 96.—*Ammannia tenuis*, C. B. Clarke, in Hook Fl. Brit. Ind. ii (1879) 567; Duthie, Fl. Upper Gang. Plain (1903) 349; Cooke, Fl. Bomb. Pres. i (1903) 506.

Stems often caespitose, creeping at the base, erect part 5.35 cm. long, simple or branching. Leaves 2-12 mm. long. 1-5 mm. broad, sessile or nearly so, broadly ovate or deltoid, sometimes rotund or oblong, obtuse or slightly acute, base subcordate. The leaves on submerged parts of the plant change their character entirely and become linear-lanceolate or narrowly linear, attaining 40 × 1 mm.

Flower-spikes slender, 4-stichous, dense or lax in the lower part. Bract one to each flower, oblong or lanceolate; bracteoles herbaceous, lanceolate, exceeding half the length of the calyx. Calyx 2·5-3 mm. long, much more elongate than that of *R. rotundifolia*; teeth 4, many times shorter than tube acute, cornua 0. Petals 4, obovate, twice as long as the calyx-teeth or slightly shorter. Stamens inserted a little below the middle of the calyx-tube. Ovary narrowly ellipsoid; style half as long as the ovary.

Capsule 2-valved, narrowly ellipsoid. Seeds brown yellow, elliptic-peltate.

Habitat :	Kolapur, Deccan	Bombay Pres.		Ritchie, No. 1068.
	Belgaum, S. M. Country.	,,		Ritchie, No. 1068.
	Dangs, on rocks, Gujerat.	,,		Woodrow, No. 19.
	Igatpuri	,,	I, 1917,	Blatt. and Hall. No. 3294-96 and 3298!
	Purandhar		XII, 1917,	Blatter, No. 3305!
	N. E. of Bhusaval, Tapti.		I, 1917,	Blatt. and Hall. No. 3297 and 3299!
	Penn, Colaba Dist.		II, 1917,	Blatt. and Hall. No. 3300-01!
	"Malabar, Concan, etc."	,,		Stocks, Law, etc.!
				Dalzell!
	Concan			T. Cooke!
	Sayu		XII, 1890,	Gangaram!
	Sevalia, Kaira Dist.		XII, 1907,	Chibber!
	Dhulia, Kandesh		XII, 1907,	Chibber!
	S. Thana		V, 1905,	Gammie!
	Pashan near Poona.		II, 1903,	Gammie!
	Poona	,,	II, 1905,	Pahardan!
	Mahim Range, Thana Dt.		XI, 1903,	G. M. Ryan, No. 2069!
	S. Thana	,,	V, 1906,	G. M. Ryan!
	Jamdevoli Dhanu.		XI, 1903,	G. M. Ryan, No. 1905!
	Bhusaval		XII, 1904,	L. D. Garade!
	Pashan near Poona.		XII, 1913,	N. P. Paranjpye!
	Agra	United Prov.		Dr. King, No. 19!
	Behar, 1,000'	Bengal		J. D. Hook.!
		W. Bengal		S. Kurz!
	Mujgowan, Rewah	C. India	I, 1874,	S. Kurz!
	Goona	,,		King, No. 25!
	Bundelkhand	United Prov.		Vicary!
	Sendwal, Khandwa Dt.	C. Prov.	XII, 1888,	Duthie, No. 8295!
	Kalapur.			

Species excludenda.

Ammannia dentelloides, Kurz, in Journ. As. Soc. Beng. XXXIX, ii (1870) 76; Clarke in Hook. f. Fl Brit. Ind. ii (1879) 568.

This plant, of which we have seen Kurz's specimen, does not belong to the *Lythraceæ*. It is *Microcarpaea muscosa*, R. Br. (*Scrophulariaceæ*.)

Kurz gives the following localities: "Frequent in Northern Bengal, as in Purneah, Kissengunge, Titalaya up to the Sikkim Terai, in dried up ponds and ricefields, shortly after the rains; also in Behar, and Arracan in Kolodyne Valley, Akyab, etc."—To this must be added the localities mentioned by Clarke under *M. muscosa*, l.c. The Herbarium of the Bombay Nat. His. Soc. contains a specimen collected by Talbot at Yellapore (N. Kanara) in Aug. 1883, and named *Ammania pentandra*, Roxb. *Microcarpaea muscosa*, R. Br., therefore, is a new member of the Flora of the Bombay Presidency.

(To be continued.)

CONTRIBUTIONS TOWARDS A FLORA OF PERSIAN BALUCHISTAN AND MAKRAN.

FROM MATERIALS SUPPLIED BY CAPT. J. E. B. HOTSON, I.A.R.O.

BY

E. BLATTER, S. J. AND PROF. F. HALLBERG.

Capt. J. E. B. Hotson has been sending considerable collections of plants from Persian Baluchistan and Makran and from British Baluchistan to our Society. Those from the Persian part of Makran and Baluchistan furnish the materials for this paper. A very small number from British Makran have been included, as they were collected during the same journey and were found almost on the borders of Persia.

The area in which the plants have been gathered lies between 25° and 28° 35′ N. Lat. and between 60° and 63° 30′ E. Long. In order to facilitate the finding of localities on the map, we give the geographical position of the more important places:

Bampur	27° 11′ N.	—60° 27′ E.
Champ	26° 38′ ,,	—60° 29′ ,,
Dehak	27° 8′ ,,	—62° 14′ ,,
Dizak	27° 21′ ,,	—62° 22′ ,,
Grawag	27° 10′ ,,	—63° 25′ ,,
Gusht	27° 48′ ,,	—61° 57′ ,,
Hong	26° 18′ ,,	—62° 8′ ,,
Khwast	28° 13′ ,,	—61° 13′ ,,
Kuhak	27° 14′ ,,	—63° 8′ ,,
Mand	26° 7′ ,,	—62° 3′ ,,
Murti	26° 48′ ,,	—62° 43′ ,,
Pahrah	27° 12′ ,,	—60° 42′ ,,
Paskuth	27° 34′ ,,	—61° 39′ ,,
Purchinan Daf	26° 36′ ,,	—62° 39′ ,,
Qasrqand	26° 12′ ,,	—60° 43′ ,,
Sar-i-Jaugan	26° 48′ ,,	—62° 34′ ,,
Sangun	28° 35′ ,,	—61° 19′ ,,
Sib	27° 14′ ,,	—62° 6′ ,,

For the physical geography and geology of Persian Baluchistan we refer to "Eastern Persia, an account of the journeys of the Persian Boundary Commission, 1870-71-72." The two volumes were published by the authority of the Government of India in 1876. Vol. I contains the "Geography with narratives by Majors St. John, Lovett, and Evan Smith," whilst in Vol. II W. T. Blanford gives an account of the zoology and geology.

RANUNCULACEÆ.

Ranunculus sp. (mat. insuff.).—Vern. name: Sanchal (information from Punjabi sepoy).

Pers. Bal.: Champ, 60 m. N. N. W. of Quasrqand, 4,000′,—23. XII, 16; Pers. Makran: Geh, 1,500′,—10. I, 17.

Ranunculus sp. (mat. insuff.).

Pers. Bal.: Bint, 1,400′,—15. I, 17.

FUMARIACEÆ.

Fumaria parviflora, Lam.

Pers. Bal.: Bint, 1,400′,—18. I, 17.

Distribution: Temperate regions of the Old World.

CRUCIFERÆ.

Draba sp.

Pers. Bal.: Gusht, 42 m. N.-W. of Dizak, 4,600′,—31. VII, 16.

Malcolmia sp. near *allyssoides* D.C.—Vern. name: Shag vishag. (Bal.).

Pers. Makran: Ziarat, 29 m. S. of Geh, 500′,—28. I, 17.

Brassica nigra, Koch.

Pers. Makran: Geh, 1476′, —21. I, 17. "I have not seen any mustard or other similar seed cultivation, but odd plants are found amongst wheat". (Hotson).

Moricanda arvensis, D C.

Pers. Makran: Pishmant, 32 m. N.N. W. of Chararbar, 300′,—31. I, 17.

Distribution: Sind, Persia, Arabia, Mediterranean region.

Crambe cordifolia, Stev.—Vern. name: Pilgosh (Bal.).

Pers. Bal.: Sirah, 34½ m. N. N. W. of Geh, 3970′,—19. I, 17.

Distribution: W. Tibet, W. Himalaya, Persia, Caucasus.

CAPPARIDACEÆ.

Cleome quinquenervia, D C.

Brit. Makran: Ispikan, 16 m. N. E. of Mand—V, 1916.

Distribution: India, Afghanistan, Persia, Arabia.

Cleome sp.

Pers. Bal.: Chah-i-Khudabakhsh, 28m. N. W. of Dizak, 4,230′—30. VII, 16.

Capparis galeata, Fres.—Vern. name.: Gorilimbuk (Bal.).

Pers. Bal.: Gusht, Mazaban Pass, 4,600′-6,300′—1. VIII, 16—11. VIII, 16; Ziaizat, 29 m. S. of Geh, 500′—28.—I, 17.

Distribution: Sind, Persia, Arabia, Nubia, Abyssinia.

Capparis galeata var. lanceolata var. nov.—Foliis lanceolatis.

Pers. Bal.: Sib.—18-24. VII, 16; Gusht, 42 m. N. W. of Dizak. 4,600′ —VIII, 16.

Capparis decidua, Pax (=*C. aphylla*, Roth)—Vern. name: Kaler.

Pers. Makran: Geh, 1,476′—21. V, 17.

Distribution: India, Persia, Arabia, N. Trop. Africa.

CARYOPHYLLACEÆ.

Dianthus sp. near *crinitus*, Sm.

Pers. Bal.: Grawan to Kant—15, VII, 16.

Sagina sp.

Pers. Bal.: Chah-i-Khudabakhsh, 28 m. N. W. of Dizak, 4,230′—30. VII, 16.

TAMARICACEÆ.

Tamarix articulata, Vahl.

Pers. Bal.: Between Grawan and Kant, 20 m. S. W. of Sib.- 15. VII, 16.

Distribution: Punjab, Rajputana, Sind, Baluchistan to Egypt and S. Africa.

Tamarix dioica Roxb.—Vern. name.: Padha gaz.

Pers. Bal.: Kaigar Pass, Bampusht Range, up to 4,500′—17. IX, 16.

Brit. Makran: Purchinan Daf, 2,300′.

Distribution: India.

Tamarix pallasii, Desv.—Vern. name: Sorem gaz.

Brit. Makran: Ispikan 16 m. N. E. of Mand; Purchinan Daf, on Nihing river, 2,300′; never found far from water, goes up to about 4,000′.

Reaumuria stocksii, Boiss.

Pers. Bal.: Sib.—21. XI, 16.

HYPERICACEÆ.

Hypericum sp.—Vern. name : Hini, hani (Bal.).
Bnut, 1,400′—15. I, 17.

ZYGOPHYLLACEÆ.

Tribulus alatus, Del.—Vern. name : Puzho.
Brit. Makran : Grawag on Mashkhil, 2,600′.
Distribution : Punjab, Rajputana, Sind, Arabia, Egypt, Nubia.
Tribulus sp.—
Persian Makran : Hong.—29. VI, 16.
Fagonia cretica L.—Vern. name : Duhulak (Bal.), Karkawag, Karkauk.
Pers. Makran : Ziarat, 29 m. S. of Geh, 500′—28. I, 17.
Pers. Bal. : Foothills of Bampusht, N. W. of Purchinan, 2,500-3000′—18. IX, 16 ; Sib,—21-24. VII, 16.
Uses : "Good camel grazing" (Hotson).
Distribution : Both shores of the Mediterranean, in S. extra-tropical Africa, warmer dry parts of Asia, Western N. and S. America.
Peganum harmala L.—Vern. name : Ispantan.
Pers. Bal.: Between Grawan and Kaut, 20 m. S. W. of Sib—15. VII, 16; Shirwan, 16 m. N.W. of Sib, 3,800′—17. X, 16; Chah-i-khundabakhsh, 28m. N. W. of Dizak, 4,230′—30. VII, 16; Maindar on N. slopes of Bampusht Range—22. IX, 16 ; between Sunt-i-Facil and Paskuh—22. VIII, 16.
Distribution : India to Mediterranean.
Peganum harmala L. *var. lanata var. nov.*—Foliis superne et inferne coopertis lana contexta alba.—Vern. name : Ispantan.
Pers. Bal. : Shirwan, 16 m. N. W. of Sib, 3,800′—15. X, 16.

GERANIACEÆ.

Erodium glaucophyllum, Ait.
Pers. Makran : Geh, 1,476′—23. I, 17.
Distribution : Mesopotamia, Arabia, Egypt, Libya, Mauritania.

RUTACEÆ.

Citrus medica, L.—Vern. name : Turunj (Bal.).
Pers. Makran : Tis, 7 m. N. of Chaharbar, 40′, in a garden—1. II, 17 : a few of these trees can be seen at many places S. of Bampur (Hotson).

CELASTRACEÆ.

Gymnosporia montana, Benth.
Pers. Bal. : Gusht, 42 m. N. W. of Dizak, 4,600′—1-3. VIII, 16.
Distribution : Central Africa, Afghanistan, India, Malaya, Australia.

RHAMNACEÆ.

Zizyphus jujuba, Lam.—Vern. name : Kunar, Ber.
Pers. Bal. : Kalgar Pass, Bampusht Range, very common from about 3,700′ down.—17. IX, 16.
Pers. Makran : Roghan ravine (*ex* Oliver B. St. John).
Distribution : Trop. Africa, Afghanistan, India, Malaya, Australia.
Zizyphus rotundifolia, Lam.—Vern. name : Kunar.
Pers. Makran : Geh, 1,476′—21. I, 17.
Distribution : India, Persia.

SAPINDACEÆ.

Dodonaea viscosa, L.—Vern. name : Anartri (Brah.).
Pers. Makran : Pugunzai Daf, 15 m. E. of Geh, 1,850′—3. I, 17.
Distribution : All warm countries.

ANACARDIACEÆ.

Pistacia khinjak, Stocks.—Vern. name: Kasur, Gwan.

Pers. Bal.: Kalgar Pass, Bampusht Range, above 3.000′—17. IX, 16; Gusht, 42 m. N. W. of Dizak—1-3. VIII, 16; Maindar—23. IX, 16; Grawan —15. VII, 16.

Uses: "Red berries are eaten." (Hotson).

Distribution: Baluchistan, Afghanistan, Gilgit, Chitral, Persia.

Pistacia mutica, Fish. & Mey. (=*P. cabulica*, Stocks).

Pers. Bal.: Surchah Paskuh—22-24. VIII, 16.

Distribution: Baluchistan, Afghanistan, Kuram Valley, Gilgit.

LEGUMINSOSÆ.

Leobordia genistoides, Fenzl.—Vern. name: Kahurkah.

Pers. Bal.: Kalgar Pass, Bampusht range, up to about 3,500′—17. IX, 16.

Distribution: Taurus.

Crotalaria burhia, Hamilt.

Pers. Makran: About 5 m. N. of Chahurbar, 200′—1. II, 17.

Distribution: Gujarat, Rajputana, Punjab, Sind, Afghanistan, Baluchistan.

Melilotus officinalis, Willd.

Pers. Makran: Geh, 1,500′—10. 1, 17.

Distribution: Europe, Orient.

Medicago denticulata, Willd.

Pers. Makran: Geh. 1,500′—10. I, 17.

Tephrosia tinctoria, Pers.—Vern. name: Matkenu, Matkianok (Bal.).

Pers. Makran: About 5 m. N. of Chahurbar, 200′—1. II, 17; Geh, 1,476′ —21. 1, 17; Ziarat, 29 m. S. of Geh, 500′—28. I, 17.

Pers. Bal.: Tuturan in Valley of Kaja river, 17 m. N. of Quasrqand, 2,300′—28. XII, 16.

Distribution: India.

Astragalus polyacanthus, Royle—Vern. name: Bazbogh.

Pers. Bal.: Kalgar Pass, Bampusht Range, 4,000-4,800′—17. IX, 16.

Uses: "Eaten by goats and sheep. Gives much milk" (Hotson).

Distribution: N. W. India, Afghanistan.

Astragalus sp.—Vern. name: Baluk.

Brit. Makran: Grawag on Mashkhil river, 2,600′—1. X, 16.

Uses: "Seeds eaten by men" (Hotson).

Astragalus sp.—Vern name: Bazbogh.

Pers. Bal: Maindar, on N. slopes of Bampusht Range—22. IX, 16. "This is said—but not positively—to be the male bazbogh. It certainly has a considerable resemblance to the ordinary bazbogh." (Hotson). It seems to be a popular fancy in Persian Baluchistan to call nearly allied species male and female. A similar case, mentioned by Capt. Hotson, will be recorded under the order *Cyperaceæ*.

Astragalus sp.—Vern. name: Shinisg.

Pers. Bal.: Chitram Pass, Bampusht Range, above about 3,000′—21. IX, 16.

Uses: Very good camel grazing.

Scorpiurus sp. (near *muricata* W.)—Vern. name: Palak (Bal.).

Pers. Makran: Geh. 1,400′—10. I, 17; Bint, 1,400′—14. I, 17.

Hippocrepis sp. (possibly *unisiliquosa* W.)

Pers. Makran: Bint, 1,400′—13. I, 17.

Taverniera ephedroidea, Jaub. & Spach.—Vern. name: Shinzok (Bal. and Brah.), Latug (Bal).

Pers. Bal.: Kaigar Pass, Bampusht Range, 2,500—4,000′, very common at all heights—17. IX, 16. Brit. Makran: Grawag, on Mashkhil river, about 2600′—1. X, 16.

Uses: Camels eat the plant, excellent sheep grazing, men eat the roots which are said to be very strengthening." (Hotson).

Distribution: S. Persia.

Note: Baker, in Hook f. Fl. Brit. Ind., II, 140, has united this species with *Taverniera nummularia*, DC., but without sufficient reason. A careful study of t. 62 in Jaub. and Spach Ill. with the corresponding description will show that *T. ephedroidea* must be retained as a distinct species. Hotson has collected specimens representing both species, and it is not difficult to distinguish the two.

Taverniera nummularia, DC.—Vern. name.: Lati, Lanti, Latug (Bal.), Shinzok (Bal. and Brah).

Pers. Makran: Ziarat, 29 m. S. of Geh, 500', very widely spread—28. I, 17; Geh, 1,476'—22. I, 17. Persian Baluchistan: Gantaf, 46 m. S. E. of Sib—15. ix, 16. On the borders between Persian and Brit. Makran: Purchinan Daf, Nihing river. 2,800'—20. IX, 16.

Uses: "Very favourite camel grazing" (Hotson).

Distribution: S. Persia, Baluchistan, Sind, Punjab. (We are not able to say whether Baker's "Afghanistan, Orient" refers to this species or *T. ephedroidea*).

Alhagi camelorum, Fisch.

Pers. Bal.: Grawan to Kant—15. VII, 16.

Distribution: India, Baluchistan, Arabia, Egypt.

Desmodium triquetrum, DC.

Persian Makran: Hong, 29. VI, 16.

Distribution India, China, Philippines, Seychelles. The distribution of this species seems to be rather erratic.

Desmodium triflorum, DC.

Pers. Makran.: Hong, 29. VI, 16.

Distribution: Cosmopolitan in the tropics.

Vicia angustifolia, Roth.

Pers. Makran: Geh, 1,476', in damp places—21. I, 17.

Distribution: Europe, Orient, India.

Note: Baker (in Hook. f. Fl. Brit. Ind., II, 178) has reduced Roth's *V. angustifolia* to a variety of *V. sativa*, L. The dwarf diffuse habit of the plant, the shorter leaflets, the lower leaves deeply emarginate at the apex. and the smaller flowers and pod seem to be sufficient reason for retaining *V. angustifolia* as a distinct species.

Lathyrus aphaca, L.

Pers. Makran: Geh, 1,476', appears to be sprinkled round the edges of bean fields chiefly—21, I, 17.

Distribution: Europe, Orient, Abyssinia, Mesopotamia, India.

Teramnus, sp.

Pers. Bal.: Suran, 24 m. E. N. E. of Parah, 2,800'—10. XII, 16.

Dalbergia sissoo, Roxb.—Vern. name: Jak (Bal.).

Pers. Makran: Tankh-i-Sirha, 27 m. N. N. W. of Geh.—19. I, 17.

Pers. Baluchistan: Kunarbasht, 22 m. W. of Kuhak, 3,600'—5. X, 16.

Distribution: India, Baluchistan, Afghanistan.

Sophora griffithii, Stocks.—Vern. name: Shahkistar, Shahkastir, Shampashtir.

Pers. Bal.: Near Gatab, 46 m. S. E. of Sib—16. IX, 16; Maindar on N slopes of Bampusht Range.

Distribution: Baluchistan, Afghanistan, Persia.

Prosopis stephaniana, Kunth.—Pers. Baluch.: Between Grawan and Kant. 20 m. S. W. of Sib.—15. VII, 16.

Distribution: Gujarat, Punjab, Afghanistan, Caucasus, Orient.

Prosopis spicigera, L.—Vern. name: Kahur.

Pers. Bal.: Kalgar Pass, Bampusht Range, up to about 4,000′—17. IX 16.

Uses: Gives an orange dye (Hotson).

Distribution: India, Afghanistan, Baluchistan, Persia.

Acacia sp.—Pers. Baluch.: Shastun, 3 m. N. W. of Dizak—28. VII, 16.

ROSACEÆ.

Prunus amygdalus, Baill.—The Almond-tree. Vern. name: Archin.

Pers. Bal.: Kalgar Pass, Bampusht Range, 4,000′-4,800′—17. IX, 16.

Distribution: Indigenous in Western Asia. Cultivated in the Mediterranean region, Persia, Afghanistan, Kashmir, Punjab.

Prunus eburnea, Aitch. and Hemsley.—Vern. name: Kotor, Mazhmong.

Pers. Bal.: Kalgar Pass, Bampusht Range, 4,000′-4,800′—17. IX, 16.

Prunus jacquemontii, Hook f.—Vern. name: Kohi Putrunk.

Pers. Bal.: Kalgar Pass, Bampusht Range, up to about 3,500′—17, IX, 16.

Prunus sp. (mat. insuff.)—Vern. name: Gwathari.

Pers. Bal.: Maindar, Bampusht Range—22. IX, 16.

Uses: "The berries are boiled to take away the bitterness. The Baluchis of these parts carry them about with meat, grains and dates as provisions for a journey." (Hotson).

Rosa sp.

Pers. Bal.: Koh-i-Tafton, 7,400-9,000′—31. X, 16.

COMBRETACEÆ.

Terminalia cattappa, L.—The Indian Almond tree. Vern. name: Bidam (Bal.). The Baluchis know it is not an Almond but give it a similar name. In Mesopotamia it is called Lo (Hotson).

Pers. Makran: Tis, 7 m. N. of Chaharbar, 40′—1. II, 17. Bears flowers and fruits at the same time.

Distribution: A widely spread litoral species within the tropics.

MYRTACEÆ.

Eugenia jambolana, Lam.—Vern. name. Jam. (Bal).

Pers. Bal.: Champ, 25 m. N.N.-W. of Qasrqand, 4,000′; Putak, in valley of Jasis river, 33 m. N. of Qasrqand, 2,900′—27. XII, 16.

Pers. Makran · Kalag-i-Jam, 13 m. E. of Bint, 1,700′—16. I, 17.

Distribution: India, Baluchistan.

LYTHRACEÆ.

Punica granatum, Lam.—Vern. name: Anar.

Pers. Bal.: Maindar on N. slope of Bampusht Range—22. IX, 16. "Appears to have larger leaves than the usual Indian pomegranate. It is said to have larger seeds and little juice (Hotson).

ONAGRACEÆ.

Epilobium hirsutum L. var. laetum, Wall ?

Pers. Bal.: Gusht, 16. VIII, 16.

Epilobium hirsutum L. var. sericeum, Benth.

Pers. Baluchistan: Grawan to Kant—15. VII, 16; Shirwan, 16 m. N. W. of Sib, 3,800′—17. X, 16.

Distribution of the type: Europe, Africa, Asia.

CUCURBITACEÆ.

Cucumis sp.

Pers. Bal.: Chah-i-khudubakhsh, 28 m. N. W. of Dizak, 4230′—30. VII, 16.

Ficoideæ.

Mollugo hirta, Thunb.—Vern. name: Hazar daru.

Pers. Bal.: Gataf,—15. IX, 16.

Distribution: All warm regions.

Umbelliferæ.

Bupleurum, sp.

Pers. Bal.: Sib,—18-24. VII, 16.

Apium graveolens, L.

Pers. Makran: Bint, 1,400′—14. I, 17.

Distribution.: Europe, N. Africa to India.

Pycnocycla spinosa, Dcne—Vern. name: Sagi dantan (=dog's tooth).

Pers. Bal.: Gusht, Mardamani nala and pass, 4600′-7300′—18. VIII, 16, between Grawan and Kant, 20 m. S. W. of Sib—15. VII, 16; Kudani Kaur, E. N. E. of Murti, Bampusht Range, 3,600′—27. IX, 16.

Ferula foetida, Regel.—Asafœtida.

Pers. Bal.: Gusht, 42m. N. W. of Dizak, 4,600′—1-3. VIII, 16; Surcha, Paskuh—22-24. VIII, 16.

"Unlike the other plants of the same family in Persia which seem to prefer barren plains or arid and exposed hills, the asafoetida is found in sheltered and comparatively damp spots among the mountains. Pottinger found it in the vicinity of Nushky, where it is collected by the Baluchis both for export and their own use. As far as I could learn, its value either as a condiment, or as an article of commerce is unknown in Western Baluchistan" (St. John in Eastern Persia, Vol. I. (1876) 57).

Daucus carota, L.

Pers. Makran: Geh, 1,476′—21. I, 17.

Distribution: Mediterranean and temperate Asiatic.

Rubiaceæ.

Jaubertia aucheri, Guill.

Pers. Bal.: Between Chak-i-Khudabakhsh, 28 m. N. W. of Dizak, 4,230′—Gusht, 14 m. further up some valley, 4,600′—31. VII, 16.

Rubia tinctorum, L.

Pers. Bal.: Gusht, 42 m. N. W. of Dizak, 4,600′—14. VIII, 16; Surchah. Paskuh—23-24. VIII, 16.

Distribution: From Kashmir through Sind and Afghanistan to Spain, wild or cultivated.

Dipsaceæ.

Scabiosa candolleana, Wall.

Pers. Bal.: Grawan to Kant—15. VII, 16.

Scabiosa sp. prope S. olivieri.

Pers. Bal.: Gusht, Mardamani nala and pass, 4,600-7,300′—10. VIII, 16.

Scabiosa sp.

Pers. Bal.: Sib—18-24. VII, 16.

Compositæ.

Phagnalon niveum, Edgew.—Vern. N.: Mor pujhok.

Pers. Bal.: Sitharo, 21 m. S. E. of Khwash, 4,600′—9. X, 16; Hills between Gazu and Sangun, 25 m. N. W. of Khwash, about 4,500′—X, 16.

Distribution: Western Himalaya, Baluchistan.

Inula grantioides, Boiss.—Vern. N.: Kolmur (Brahui), Kolmir, Kulmir. Pir (Bal.).

Pers. Makran: Ispikan, 16 m. N. E. of Mand—V, 16; Geh, 1,476′—21. I, 17; Qasrqand, 1,710′—29. XII, 16; Ziarat, 29 m. S. of Geh, 500′—28.

I, 17. Pers. Bal.: Surmich, 40 m. S. of Bampur, 3,200′; Kudani Kaur, E. N. E. of Murti, Bampusht Range, 3,500′, common to about 2,800′—27. IX, 16; common in parts of the Bampusht country and in the Nihing valley—22. XII, 16.

Uses: Good camel grazing.

Distribution: Sind, Baluchistan, Wuzuristan, Arabia.

Pulicaria glaucescens, Jaub. & Spach.—Vern. N.: Kolbur (Bal. and Brah.) Kunchid.

Pers. Makran: Ziarat, 29 m. S. of Geh, 500′—20. I, 17; Geh, 1,476′—22. I, 17. Pers. Bal.: In the Shahrikaur up to about 3,500′; Kalgar Pass, Bampusht Range up to about 3,500′—17. IX, 16; Sar Bug, 10½ m. W. of Qasrqand, 1,500′—2. I, 17; Brit. Makran: Purchinan Daf—20. IX, 16.

Uses: "It is ravenously eaten by camels and is reputed to be strengthening to them; but it is a strong purgative." (Hotson).

Distribution: Punjab, Wuzuristan Baluchistan, Persia.

Pulicaria boissieri, Hook. f.—Vern. N.: Kunchid.

Purchinan Daf (Brit. Makran)—20. IX,16.

Distribution.: Sind, Baluchistan.

Pulicaria sp.

Pers. Bal.: Gor-i-Kabal, 35 m. E. N. E. of Pahrah, 3,300′—8. XII, 16.

Pulicaria sp. Saidran—14. VII, 16 (geographical position ?).

Tanacetum gracile (?) Hook. f. and Th.—Vern. N.: Drani.

Brit. Makran: Grawag on Mashkhil river, about 2,600′—1. X, 16.

Distribution: West. Tibet, West. Himalaya, Brit. Baluchistan.

Uses: "Said to be used as a cooling medicine" (Hotson).

Artemisia sp. (possibly *stricta*, Edgew.).

Pers. Makran: Nur Muhammadi, 12 m. N. W. of Chahabar, 60′—31. I, 17.

Calendula sp.—Vern. N.: Padamok.

Pers. Bal.: Surmich, 40 m. S. of Bampur, 3,200′, common all over the country on the edge of running water—22. XII, 16.

Pers. Makran: Geh, 1,476′—21. I, 17.

Cousinia sp.

Pers. Makran: Bint, 1,400′, dry hillsides—14. I, 17.

Cousinia sp.

Among hills, 10 m. S. W. of Dizak—25. VII, 16.

Carduus nutans, L.

Pers. Bal.: Gusht, Mardamani nala and pass, 4,600′-7,300′—10. VIII, 16.

Distribution: Northern Asia, Western Tibet, Western Himalaya, Punjab to N. Africa and W. Europe.

Launœa sp.

Pers. Bal.: Shastan, 3 m. N. W. of Dizak—28. VII, 16.

Launœa sp.—Vern. N.: Shahri karchok.

Pers. Bal.: Gati, in valley of Kaja river, 16 m. N. of Qasrqand, 2,200′—28. XII, 16.

Launaea polyclada (?) Boiss.

Pers. Bal.: Gusht, 42 m. N. W. of Dizah, 4,600′—14. VIII, 16.

Scorzonera ramosissima DC.—Vern. N.: Khargosh kah.

Pers. Bal.: Maindar on N. slope of Bampusht Range, very widely spread where there is a little moisture—23. IX, 16.

PLUMBAGINACEÆ.

Statice sp., nearest to *S. carnosa*, DC., *fortassis sp. nov.*

Pers. Bal.: Paskuh, 32 m. N. W. of Sib., 4,040′—18. X, 16.

Uses: Eaten by camels and goats (Hotson).

PRIMULACEÆ.

Anagallis arvensis, L.
Pers. Bal.: Gusht—1. VIII, 16.
Anagallis arvensis L. var. caerulea (=*A. caerulea*, Lam.).
Pers. Makran: Geh, 1,650′—4. 1, 17.
Distribution of the species: Europe, Western Asia, introduced into most temperate regions.

Samolus valerandi, L.
Pers. Bal.: Gusht—16, VIII, 16.
Distribution: From the Western Himalaya westwards, most temperate regions.

OLEACEÆ.

Olea cuspidata, Wall.—Vern. name: Hath.
Pers. Bal.: Maindar on N. slopes of Bampusht Range, 4,500′, on the highest parts of the range both N. and S. of the crest. Said to grow into a big tree.—23. IX, 16.
Uses: The wood is very hard and makes good charcoal (Hotson).
Distribution: N. W. Himalaya, Cabul, Baluchistan.

SALVADORACEÆ.

Salvadora oleoides, Dcne.—Vern. name: Pir (Bal., W. Makrani), Kabad (Brahui), Kabar (Kech Makrani, etc.).
Pers. Bal.: Kalgar Pass, Bampusht Range, up to about 3,500′, very common up to about 3,000′.
Distribution: Punjab, Rajputana, Sind, Baluchistan, Arabia.

APOCYNACEÆ.

Nerium odorum, Soland.—Vern. name: Jaur.
Pers. Bal.: Kalgar Pass, Bampusht Range, common wherever land has gone out of cultivation (Hotson)—17. IX, 16.
Distribution: Baluchistan, Afghanistan, India, Japan.

Rhazya stricta, Dcne.—Vern. name: Hezhwary, Herhwar.
Pers. Bal: Chah-i-Khudabakhsh, 28 m. N. W. of Dizak, 4,230′—30. VII, 16; common wherever land has gone out of cultivation.
Pers. Makran: Pugunzai Daf, 15 m. from Geh, 1,850′—4. I, 17; Geh, 1,476′—21. I, 17.
Distribution: India, Baluchistan, Afghanistan, Arabia.
Note: Cooke (Fl. Bomb. Pres. II, 130) says that the bracts are pubescent and ciliate. In our specimens they are quite glabrous.

ASCLEPIADACEÆ.

Tylophora tenuis, Bl.
Ispid Zamin—1. VIII, 16.
Distribution: India, Java, Borneo.

Periploca aphylla, Dcne.
Brit. Makran.—12 and 14. VII, 16.
Distribution; Punjab, Sind, Afghanistan, Persia, Arabia, Nubia.

Calotropis procera, R. Br.—Vern. name: Kurag (Bal.), Kark, Ak, Ank, Akda, etc.
Pers. Makran: Geh, 1,476′, throughout Makran in suitable ground—21. I, 17.
Pers. Bal.: Kunarbast, 22 m. W. of Kuhak, 3,600′, seen in flower all over Bampusht and the North side of the Mashkil—5. X, 16.

Boucerosia aucheriana, Dcne.—Vern. name: Marmot.

Pers. Bal.: Maindar on N. slopes of Bampusht Range—23. IX, 16.
Uses: Has a very bitter taste. Is said to be used as a cure for worms (Hotson).
Distribution: Punjab, Baluchistan, Afghanistan, Persia, Arabia.

GENTIANACEÆ.

Erythræa roxburghii G. Don. *var. macrantha var. nov.*—Corolla multo longior typo.
Pers. Bal.: Gusht, Marzaban Pass, 4,600′-6,300′—11. VIII, 16.
Distribution of type: India.

BORAGINACEÆ.

Cordia myxa, L.
Pers. Makran: Geh, 1,476′, 'so far as I remember this is the only tree of the kind I have seen. It is in the garden of a small mosque' (Hotson).—21. I, 17.
From Egypt to Cochin China, and Australia, often planted.
Heliotropium eichwaldi, Steud.
Pers. Bal.: Gusht, 42 m. N. W. of Dizak, 4,600′—1-3. VIII, 16.
Distribution: W. and C. Asia, India, Australia.
Heliotropium eichwaldi, Steud. *var. lasiocarpum*, C. B. Clarke.
Pers. Bal.: Gusht—1. VIII, 16.
Distribution: N. W. India.
Heliotropium undulatum, Vahl.
Brit. Makran: Grawag on Mushkhil, 2,600—1. X, 16.
Distribution: N. Africa, W. Asia, Baluchistan, India.
Heliotropium rariflorum, Stocks.—Vern. name: Washbu.
Pers. Makran: Ziarat, 29 m. S. of Geh, 500′—28. I, 17.
Distribution: Punjab, Sind, Baluchistan, Afghanistan, Socotra, Nubia.
Heliotropium tuberculosum, Boiss.
Pers. Makran: Nur Muhammadi, 22 m. N. W. of Charbar, 60′—31. I, 17.
Heliotropium prope brevifolium, Wall.
Brit. Makran: Grawag, on Mashkhil, 2,600′—1. X, 16.
Uses: Eaten by sheep (Hotson).
Heliotropium sp.
Pers. Bal.: Gusht, 42 m. N. W. of Dizah, 4,600′—1-3. VIII, 16.
Heliotropium sp.—Vern. name: Meshir.
Brit. Makran: Grawag, on Mashkhil, about 2,600′—1, X, 16.
Uses: Eaten by sheep (Hotson).
Trichodesma africanum, R. Br.—Vern. name: Charmaing (Brah.).
Pers. Bal.: Tuturan, in valley of Kaja river, 17 m. N. of Qasrqand, 2,300′—28. XII, 16.
Distribution: Trop. Africa, Arabia, Persia, Afghanistan, Sind, Punjab.
Trichodesma indicum, Br.
Bint, dry hillsides, 1,400′—14. I, 17.

CONVOLVULACEÆ.

Convolvulus arvensis, L.
Bint, on the edge of water channels, 1,430′—15. I, 17.
Distribution: Nearly all temperate and subtropical countries.
Convolvulus sp. prope microphyllus, Sib.—Vern. name: Hushtarkah (Bal.).
Pers. Makran: Ziarat, 29 m. S. of Geh, 500′—28. I, 17.
Cressa cretica, L.
Pers. Makran: Nur Muhammadi, 22 m. N. W. of Chahbar, 60′—31. 17.
Distribution: All warm regions.

Cuscuta chinensis, Lam. *var. minor*, Chois.
Pers. Bal.: Chah-i-Kudabakhsh, 28 m. N.-W. of Dizak, 4,230′—30. VII, 16.—Parasitic on *Ephedra*.
Distribution of type: From Persia to Australia.

SOLANACEÆ.

Solanum nigrum, L.—Vern. N.: Tolangur.
Pers. Bal.: Gusht—1-16. VIII, 16; Shastun, 3 m. N.-W. of Dizak—28. VII, 16.
Brit. Makran: Grawag on Mashkhil, about 2,600′—1. X, 16.
Uses: The berries are eaten by men. (Hotson).
Distribution: All temperate and tropical regions.
Solanum sp. (*prope ferox*).—Vern. N.: Gonch (Bal.).
Pers. Bal.: Putak—27. XII, 16; Qasrqand, 1,710′—29. XII, 16; Tuturan in valley of Kaja river, 16 m. N. of Qasrqand, 2,200′—28. XII, 16.
Pers. Makran: Geh, 1,650′—4. I, 17.
Withania somnifera, Dun.—Vern. N.: Kapink (Bal.).
Pers. Makran: Geh, 1,476′—21. I, 17.
Pers. Bal: Gusht, Mardamanin nala and pass, 4,600′—7,300′, 10. VII, 16: Shastun, 3 m. N.-W. of Dizak—28. VII, 16.
Distribution: Mediterranean region, Cape of Good Hope, India.
Withania coagulans, Dun.—Vern. N.: Panerbad (Bal.), Panrband (Brah.).
Pers. Bal.: Kalgar pass, Bampusht range up to about 3,500′— 17. IX, 16.
Note: "This plant is said to get its name from its use in curdling milk to make cheese" (Hotson).
Distribution: Punjab, Sind, Afghanistan.
Lycium europaeum, L.—Vern. N.: Zirok (Bal.), Zirab (Bampuri Bal.), Kotur.
Pers. Makran: Geh, 1,650′—4. I, 17.
Pers. Bal.: Kalgar pass, Bampusht range up to about 3,500′—17. IX, 16; Kuh-i-Soptah, 17 m. E. of Bampur, 2,500′—11. XII, 16. Grows at all heights from 1,500′, possibly lower, to 5,000′ at least (Hotson).
Uses: "Has a pretty red berry with a pleasant flavour. Its leaves are cooked and eaten" (Hotson).
Distribution: Mediterranean region, W. Asia, W. India.
Hyocyamus muticus, L.—Vern. N.: Kohi-bhang (Bal.), Bhang-i-divanah (Pers.).
Pers. Bal.: On rocks at Moren Pish, 27 m. S. S. E. of Bampur, 3,100′—21. XII, 16.
Pers. Makran: Pugunzai Daf, 15 m. E. of Geh, 1,850′-3. I, 17.
Distribution: Punjab, Sind, Afghanistan, Baluchistan to Egypt.
Hyoscyamus reticulatus, L.
Pers. Makran: Bint, 1,400′—14. I, 17.

SCROPHULARIACEÆ.

Linaria cabulica, Benth.
Pers. Bal.: Grows in clefts in rocks at Moren Pish, 27 m. S. S. E. of Bampur, 3,100′—21. XII, 16.
Distribution: India to Persia.
Anarrhinum sp. prope laxiflorum, Boiss.
Brit. Makran: 14. VII, 16.

OROBANCHACEÆ.

Cistanche tubulosa, Wight. Vern. N.: Birahi (Bal.).
Gati, in valley of Kaja river, 16 m. N. of Qasrqand, 2,200′; a number of plants in flower among neglected wheat cultivation, 2,200′—28. XII, 16.

Distribution : Central Asia, Punjab, Rajputana, Sind to Arabia.
Orobanche hirtiflora, Reut.
Pers. Bal. : Near Gazar 25 m. N. E. of Khwash, 4,808′—28. X, 16.

PEDALIACEÆ.

Sesamum indicum, DC.
Pers. Bal. : Dizak—28. VII, 16.
Distribution : Native country doubtful. Cultivated in all hot countries.

VERBENACEÆ.

Vitex agnus castus, L.—Vern. N. : Gwanik.
Pers. Bal. ; Murti on N. slopes of Bampusht range.—25. IX, 16; Surchah, Paskuh—22-23. VIII, 16.
Vitex negundo, L.
Pers. Bal. : Between Grawan and Kant, 20 miles S. W. of Sib,—15. VII, 16.
Distribution : Afghanistan, India to the Philippines.

LABIATÆ.

Ocimum basilicum, L. *var. thyrsiflora*, Wight.—Vern. N. : Nazbu.
Pers. Bal. : Hiduch, 18 m. S. of Sib, 4000′—13. IX, 16.
Distribution of type : Hotter parts of Old World, probably cultivated.
Mentha sylvestris, L.—Vern. N. : Purchink.
Brit. Makran : 14. VII, 16. Pers. Bal. : Maindar on N. slopes of Bampusht Range, common everywhere near water—22. IX, 16.
Uses : Used like mint as a vegetable and flavouring material (Hotson).
Distribution : Europe, W. and C. Asia.
Perowskia abrotanoides, Kiril.
Pers. Bal. : Kho-i-Taftan, about 3,000′—30. X, 16; Gusht, Marzaban Pass, 4,600-6300′—11. VIII, 16.
Distribution : Western Tibet, Afghanistan, Baluchistan, Persia, Turcomania.
Perowskia sp. Gusht, Mardonani nala and pass, 4600-7300′—10. VIII, 16.
Salvia santolinæfolia, Boiss.
Pers. Bal. : Sitahro, 21m. S. E. of Khwash, 4600′—9. XI, 16.
Distribution : Sind, Baluchistan, Afghanistan, Persia.
Nepeta sp. prope leucolaena Benth.—Vern. N. : Simsok (Bal. and Brah.).
Pers. Bal. : Zardan, 55 m. S. E. of Sib—16. IX, 16.
Uses : 'The water in which this plant is soaked is said to be good for colds and fevers' (Hotson).
Otostegia aucheri, Boiss.—Vern. N. : Shinisg (Bal.)=small shinz (camel thorn).
Pers. Bal. : Sib—18-24. VII, 16; Hamkan Kaur, N. N. W. of Irafshan, 3,000′—13. VII, 16.
Brit. Makran : Ispikan, 16 m. N. E. of Mand—V, 16.
Uses : Very greedily eaten by camels.
Distribution : S. Persia, Baluchistan.
Otostegia sp. (*prope aucheri*, Boiss.)—Vern. N. : Kuntak.
Pers. Bal. : Chitkani pass, Bampusht range, above 2,500′; between Grawan and Kant, 20 m. S. W. of Sib—15. VII, 16.
Uses : Good camel grazing (Hotson).
Otostegia microphylia, Boiss.—Vern. N. : Guldir (Bal.), Gulgidir (Brah.).
Pers. Bal. : Gusht, 42 m. N. W. of Dizak, 4,600′—1-3. VIII, 16; Kalgar pass, Bampusht range, up to about 4,000′—18. IX, 16.
Uses : The leaves are either boiled or soaked in water all night and the water drunk as a medicine (Hotson).
Distribution : S. Persia.
Leucas glaberrima, Jaub. Spach. Grawan—15. VII, 16.

Distribution: Arabia.

Eremostachys vicaryi, Benth.

Grawan.

Teucrium stocksianum, Boiss.—Vern. N.:—Kalporag.

Pers. Bal.: Chitkani pass, Bampusht range, about 4000′—22. IX, 16. Maindar—22. IX, 16.

Uses: Has a pleasant scent, the plant is boiled and allowed to stand all night. The water is then drunk as a remedy for colds (Hotson).

Zizyphora clinopodioides, Bieb.—Vern. N.: Purchink (Bal.), Pudina (Pers.).

Pers. Bal.: Chitkani Pass, Bampusht Range, 3,000′ and above—21. IX, 16.

Zitaria multiflora, Boiss.—Vern. N. Isghand (Brah. and Bal.), Isgind (Bal.).

Pers. Bal.: Sar-i-Jangan, N. of Kalgar Pass, Bampusht Range, 4,400, —16. IX, 16; Tankh-i-Sirah, 27 m. N. N.-W. of Geh, 3,400′—19. I, 17: Tuturan, in valley of Kaja river, 17 m. N. of Qasrqand, 2,300′—28. XII, 16; Maindar—25. X, 16.

Uses: A specific when soaked in water for stomach complaints. It is used to give a pleasant smell to ghi. (Hotson).

PLANTAGINACEÆ.

Plantago amplexicaulis, Cav.

Pers. Makran.: Geh, 1,476′—21. I, 17.

Distribution: From India to Egypt and Greece.

Plantago ciliata, Desf.

Pers. Bal.: Shastun, 3 m. N.-W. of Dizak,—28. VII, 16.

Distribution: From the Punjab to Arabia and Egypt.

Plantago coronopus, L.

Pers. Bal.: Gusht. 42 m. N.-W. of Dizak, 4,600′—14. VIII, 16.

NYCTAGINACEÆ.

Boerhaavia elegans, Chois.—Vern. N.: Sohrpol (Bal.).

Pers. Makran.: Ziarat 29 m. S. of Geh, 500′—28. I, 17.

Brit. Makran: Ispikan, 16 m N.-E. of Mand.

Distribution: Punjab, Rajputana, Sind, Baluchistan, S. Arabia.

AMARANTACEÆ.

Ærua tomentosa, Forsk. (=*A. javanica*, Wight. Vern. N.: Puzhalo.

Pers. Bal.: Kaigar pass, Bampusht range, up to about 3,700′—17. IX, 16. Aptar, 12 m. E. of Pahrah, 2,000′—18. XII, 16.

Brit. Makran: Ispikan, 16 m N.-E. of Mand—V, 16.

Uses: The white flowers are used as a substitute for cotton to fill pillows (Hotson).

Distribution: Cape Verd Islands, E. and W. trop. Africa, North Africa. Yemen, India, Ceylon (not Java!).

Ærua lanata, Juss.

Pers. Bal.: Pahrah, 1,870′—13. XII, 16.

Pers. Makran: Geh, 2,476′—22. I, 17.

Distribution: Throughout Africa, and warm parts of Asia to the Philippines.

Ærua sp.—Vern. N.: Sib.

Pers. Bal.: Gazbastan Tankh, 6 m. N. E. of Kuhak, about 2,800′—28. IX, 16.

Uses: Eaten by goats (Hotson).

Aerua sp.

Brit. Makran: Grawag, on Mashkhil river, about 2,600′—1. X, 16.

CHENOPODIACEAE.

Chenopodium sp.

Pers. Bal.: Among hills, 10 m. S. W. of Dizak—25. VII, 16.

Chenopodium sp.

Pers. Bal.: Chah-i-Khudabakhsh, 28 m. N. W. of Dizak, 4,230′—30. VII, 16.

Salicornia sp.—Vern. N.: Shurdog.

Pers. Bal.: Foothills of Bampusht Range, N. W. of Purchinan Daf, 2,500′—18. IX, 16.

Suaeda sp. Vern. N.: Simsur.

Pers. Bal.: Kudani Kaur, E. N. E. of Murti Bampusht range, about 3,500′—27. IX, 16.

Note: This plant with red stem is reputed to be the male of the Simsur with green stem. Both kinds are eaten by men. When mature they are bitter, but are said to be sweet when young (Hotson).

Haloxylon recurvum, Bunge.—Vern. N.: Gwamich.

Pers. Bal.: Gazbastun Tankh, 6 m. N. E. of Kuhak, about 2,800′, found up to 5,000′—28. IX, 16.

Uses: The plant is made into soap by being rotted with a little water (Hotson).

Distribution: India, Afghanistan, Baluchistan, Yunan.

Haloxylon salicornium, Bunge.—Vern. N.: Trat, Chahmugh.

Pers. Bal.: Rabat, 19 m. S. W. of Kwash, 4,300′—20. X, 16; foothills of Bampusht Range, N. of Purchinan, 2,800′—18. IX, 16.

Uses: Excellent camel grazing (Hotson).

Distribution: Sind, Baluchistan, Afghanistan.

Salsola fœtida, Del.—Vern. N.: Sorag, Mesh-sorag.

Pers. Bal.: Foothills of Bampusht range, N. W. of Purchinan—Daf, about 2,500′, found up to at least 4,800′—18. IX, 16.

Uses: Excellent grazing for sheep and goats; also eaten by camels.

Distribution: N. Africa, Arabia, Persia, Baluchistan, N. W. India.

Salsola sp. prope decurrens.—Vern. N.: Chamagh, Chakmagh, Chamaga.

Pers. Bal.: Darin Chak, 51 m. N. W. of Sib, 4,500′—14. X, 16. Paskuh, 32 m. N. W. of Sib, 4,500′—19. X, 16.

Uses: Contains much water; greedily eaten by all grazing animals (Hotson).

POLYGONACEAE.

Calligonum polygonoides, L.

Pers. Bal.: Chah-i-Khudabakhsh, 28 m. N. W. of Dizak, 4,230′—30. VII, 16.

Distribution; Syria, Armenia, Persia, Sind, Rajputana, Punjab.

Pteropyrum olivieri, Jaub. & Spach.—Vern. N.: Tul-i-Mach (W. Makran) Kurawan-Kush.

Pers. Bal.: Sib—18-24. VII, 16; Chah-i-Khudabakhsh, 28 m. N. W. of Dizak, 4,230′—30. VII, 16; Aptar, 12 m. S. of Pahrah, 2,000′—11. XII, 16.

Pers. Makran: Ziarat, 29 m. S. of Geh, 500′—28. I, 17.

Distribution; Persia, Baluchistan, Sind, Afghanistan.

Polygonum plebejum, Br.

Pers. Bal.: Gusht, 42 m. N. W. of Dizak, 4,600′—VIII, 16.

Distribution: Trop. and S. Africa, Egypt, Baluchistan, Afghanistan, India, Trop. Asia, Java, Philippines.

Polygonum barbatum, L.

Pers. Bal.: Gusht, 4,600′.

Distribution: Trop. Asia and Africa.

Polygonum sp.

Pers. Bal.: Surchah, Paskuh—22-24. VIII, 16.

Rumex dentatus, L.

Per. Bal.: Gusht.—16. VIII, 16; between Grawan and Kant, 20 m. S. W. of Sib.—15. VIII, 16.

Rumex roseus, L.

Pers. Bal.: Aspagan, 46 m. S. of Bampur, 3,500′—23. XII, 16.

Rumex sp.

Brit. Makran: Ispikan, 16 m. N. E. of Mand—V, 16.

Rumex sp.

Pers. Makran: Chahbar, 20′—2. II, 17.

THYMELÆACEÆ.

Thymelæa arvensis, Lam.

Pers. Bal.: Gusht, 4,600′—1-3. VIII, 16.

Distribution: From Kashmir and the Punjab to N. Africa and France.

ELAEAGNACEÆ.

Elaeagnus hortensis, M. Bieb.—Vern. N. Sintad.

Pers. Bal.: Koh-i-Taftan, up to at least 8,000′.—30. X, 16.

Distribution: Spain to W. and C. Asia and China.

EUPHORBIACEÆ.

Euphorbia helioscopia, L.—Vern. N.: Sohrbulok (Bal.).

Pers. Makran: Geh., 1,476′—21. I, 17; Bint, 1,400′, near water channels 15. I, 17.

Distribution: From the Atlantic to India, Japan.

Euphorbia falcata, L.

Pers. Bal.: Gusht, 4,600′—1-3. VIII, 16.

Distribution: From the Mediterranean region to the Punjab.

Euphorbia tirucalli, L.—Vern. N.: Dedar (Bal.).

Pers. Makran: Geh, 1,476′, very common as a hedge at the Qasrqand-Geh-Bint level (1,300′-1,700′), but not seen at greater elevation—21. I, 17.

Distribution: Native of Africa, introduced into Asia.

Euphorbia sp.—Vern. N.: Patibe (Brah.).

Pers. Makran: Nokh-i-Jahan, 14 m. S. of Geh., 700′—27. I, 17.

Euphorbia sp. Bint, 1,400′—15. I, 17.

Euphorbia sp. Pers. Bal.: Gusht—1. VIII, 16.

Chrozophora verbascifolia, Willd.—Vern. N.: Tirok.

Pers. Bal: Murti, on N. slopes of Bampusht range—25. IX, 16; Shastun, 3 m. N. W. of Dizak—28. VII, 16.

URTICACEÆ.

Ficus bengalensis, L.—Vern. N.: Wad, Bar.

Pers. Makran: Tis, 7 m N. of Chahbar, there are a considerable number of well-grown trees here, the first place we have seen them in this country. —1. II, 17.

Distribution: Indigenous in parts of India, planted elsewhere.

Ficus palmata, Forsk.—Vern. N.: Hinjir, Anjir.

Pers. Bal.: Kalgar pass, Bampusht range, 3,500′-4,500′—17. IX, 16; between Grawan and Kant—13. VII, 16.

Distribution: From India to Egypt and Abyssinia.

Morus alba, L —Vern. N.: Tut.

Pers. Bal.: Maindar, on N. slopes of Bampusht range—22. IX, 16.

Distribution: Indigenous in N. and W. Asia and Afghanistan, cultivated elsewhere.

SALICACEÆ.

Salix tetrasperma, Roxb.—Vern. N.: Bhed.

Pers. Bal.: Kaigar pass, Bampusht range, up to about 3,800′—17. IX, 16.

Distribution : Indo-Malayan.

Populus euphratica, Oliv.—Vern. N. : Padagh.

Pers. Bal. : Sar-i-Sorag, 40 m. N. W. of Sib., about 4,100′—19. X, 16.

Distribution : Central Asia, Western Tibet, N. W. India, Sind to Syria and Egypt.

GNETACEÆ.

Ephedra intermedia, Stapf.—Vern. N. : Hom.

Pers. Bal. : Maindar, on N. slopes of Bampusht Range—23. IX, 16 : Rabat, 19 m. S. E. of Khwash, 4,300′—20. X, 16.

Uses : Is mixed with Tobacco and smoked in pipes (Hotson).

Ephedra intermedia var. glauca, Stapf.—Vern. N. : Roghan gaz (Bal.). Por-gaz (Brah.).

Kalag-i-jam, 13 m. E. of Bint, 1,700′—16. I, 17.

Distribution : From Mongolia to Kashmir and Turkestan.

Ephedra intermedia var. tibetica, Stapf.—Vern. N. : Marizad.

Pers. Bal. : Kudani Kaur, E.N.E. of Murti, Bampusht range, 3,500′—27. IX, 16; Chah-i-Khudabakhsh, 4,230′—30. VII, 16.

Distribution : Western Tibet, Afghanistan, Khoten.

Ephedra nebrodensis, Stapf.—Vern. N. : Gwatham.

Pers. Bal : Chitkani pass, Bampusht range, about 4,000′—22. IX, 16.

Brit. Makran : Puchinan Daf, Nihing river, 2,300′—20. IX, 16.

Uses : The fruits are eaten. They are bitter and are soaked several times to take out the bitterness. They have little taste (Hotson).

Distribution : Kuhlwar, Lahul, Western Tibet, Afghanistan and eastward to Greece.

Ephedra foliata, Stapf. *var. ciliata*, Stapf.

Pers. Makran : Nur Muhammadi, 22 m. N.-W. of Chahbar. 60′—31. I, 17.

CONIFERÆ.

Cupressus sempervirens, L. *var. horizontalis*.

Pers. Bal. : Sangun, 31 m. N.-E. of Khwash, about 5,500′—29. X, 16.

"This particular individual is venerated as a prophet and named Mir Umr." (Hotson). Probably planted.

Distribution : Persia, Syria, Asia Minor.

IRIDACEÆ.

Iris aitchisoni, Boiss.—Vern. N. : Chabuki.

Bint, 1,400′, in great profusion along water channels and in irrigated land.—13. I, 17.

Distribution : Punjab, Baluchistan, Afghanistan.

LILIACEÆ.

Asphodelus tenuifolius, Cavan.

Pers. Bal. : Sar Bug, 10½ m. W. of Qasrqand, 1,500′—2. I, 17.

Distribution : From India to the Canary Islands.

JUNCACEÆ.

Juncus maritimus, Lam.

Pers. Bal. : Grawan—15. VII, 16.

Distribution : Cosmopolitan.

PALMÆ.

Phœnix dactylifera, L.

Pers. Makran : Geh. 1,476′—26. I, 17.

CYPERACEÆ.

Schœnus nigricans, L.—Vern. N. : Tusg.

Pers. Bal. : Grawan—VII, 16; Maindar, on N. Slopes of Bampusht range, common near water, especially marshy places—22. IX, 16.

Distribution. : Nearly cosmopolitan, except S. E. Asia and Australia.

Uses : For matting, particularly the mosques.

Cyperus sp.

Pers. Bal. : Grawan—15. VII, 16.

GRAMINEÆ.

Oryza sativa, L.—Rice.

Pers. Makran, 1,476'—21. I, 17.

"This rice is sown in late December or early January. Some has already been transplanted, most has not. The variety is called 'Siah'= black" (Hotson).

Andropogon contortus, L.—Vern. N. : Abdarkan (Bal.)

Pers. Makran : Ziarat, 29 m. S. of Geh., 500'—28. I, 17.

Distribution : Mediterranean region and tropics generally.

Phragmites communis, Trin.

Pers. Bal. : Gusht, Mardamani nala and pass, 4,600'—7,300'—10. VIII, 16.

Triticum vulgare, Vill.—Wheat.

Pers. Makran : Geh., 1,476'—21. I, 17.

"Is sown in November to December. Local wheat is red and hard" (Hotson).

Aristida plumosa, L.—Vern. N.: Mazh.

Pers. Bal. : Gazbastan Tankh, 6 m. N. E. of Kuhak, about 2,800'—28. IX, 16.

Distribution : From W. Tibet to North Africa.

Aristida sp.

Pers. Bal.: Gusht, 4600'—31. VII, 16.

Eremurus sp.—Vern N. : Shej.

Pers. Bal. . Murti, N. W. slopes of Bampusht range—25. IX, 16.

Uses : Very good grazing, especially for horses (Hotson).

FILICES.

Adiantum capillus Veneris, L.

Pers. Bal. : Hong—29. VI, 16; Gusht, Mardamani nala and pass, 4,600 7300'—10. VIII, 16; Marzaban pass, 4,600'—6,300'—11. VIII, 16.

Distribution. : Cosmopolitan.

Cheilanthes fragrans, Swartz.

Pers. Bal. : Gusht, Marzaban Pass, 4,600'—6,300'—11. VIII, 16.

Distribution. : Kashmir, Cabul, Mediterranean region.

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MISCELLANEOUS NOTES.

No. I.—NOTES FROM THE ORIENTAL SPORTING MAGAZINE. NEW SERIES, 1869 to 1879.

Size of Wild Boars.

A number of contributors corresponded as to weight and size of wild boars, and what appear to be the more careful records of these are given below:—

	Height.	Length.	Girth.	Neck.	Weight. lbs.
Seroor, Beema River ..	38½	..	.	..	300
	37½	..	..	..	258
	35½	..		..	155
	35	..	..	..	216
	33½	..	..	..	196
	33	..	..	..	162
Deccan, Poona ..	..	64½"	51"	43"	234
Sind, Jacobabad ..	38	61	46½	36	191
	37	58½	42	..	162
	37¾	60	48½	..	209
	36	59	44	..	185
	36	61	46	..	..
	35	60	44	..	185
	34	59	..	..	165
	32	55	40	..	..
	32	53	..	..	130
	31	57	41½	..	..
	31	59½	40	..	150
Durbungah, Reyam Factory	37½	65	..	..	281
	36½	62	..	..	270
	36	60	.	..	260
	36	56	..	..	236
	35	58	..	.	247
	34	66	..	..	270
Tirhoot, Assam ..	34	57	..	..	243
	32	64	45	..	250
	30½	60	46	..	252

The Sind boars appear to be "lean kine" as compared with those of the Deccan and Assam.

A monster boar is recorded from the Helmund River, Afghanistan.
Height 37½, length 62, girth 55, forearm 11, weight 266 lbs.

Musk Deer.

At p. 300 of Vol. IX, 1876: mention is made of the belief that the size of the pod of the musk deer varies with the increasing and waning of the moon. Marco Polo mentions the same in his travels, and it is commonly believed and asserted by the hill men and shikaris of the lower Himalayas. The writer has shot two musk deer only, each of which weighed 30 lbs and the pod of the one, shot on a day when the moon was full, was larger than that of the animal killed when the moon was 5 or 6 days on the wane: but a large series of observations would be necessary to arrive at a proper conclusion in the matter.

Hillmen, north of Mussoorie, told the writer that the panther is sometimes killed by the male musk deer who, when seized by the throat, jabs his tusks into the panther's head! It can be imagined that no instance of such an occurrence could be quoted by the relators of this fanciful story.

WEIGHTS AND MEASUREMENTS OF ANIMALS.

The following may be of interest :—

13	Panthers,	male,	Central India,	Av.	Length	7′
3	„	female	„	„	„	6′ 6″
9	Bears,	male	„	„	„	6′
2	„	female	„	„	„	5′ 9½″
2	Cheetahs,	male	„	„	„	6′ 10″ 6′ 6″

1 Panther,	male, Dharmsala, length 7′ 5″ weight 110 lbs.
Sloth-bear,	male, 4′ 9″, 232 lbs.
Porcupine,	female, 33 lbs.
Black Buck,	Allahabad, 95, 91, 91, 84, 86 lbs.
„ „	Budaun (C.P.) 80, 74, 70, 69, 61 lbs.
Chinkara,	male, 39½, 38, 36, 33 lbs.
„	female, 30, 28½, 24 lbs.
Wolf,	female, 52 lbs.

Thibetan Antelope, 62, 60, 50 lbs. these grallochced and with heads removed.

Thibetan Gazelle, 47, 40 lbs.

To these the writer can add :—

Chinkara,	Hyderabad, Deccan, male 42 lbs.
„	Delhi District, male 50 lbs.
Musk Deer,	Chakrata Hills, male 30 lbs.

R. W. BURTON, LT.-COL.,
Indian Army.

BOMBAY, *3rd October* 1917.

No. II.—CROWS IN BUSRAH.

A few days ago I observed, at quite close quarters, and on the ground, a "Hooded" crow which, from the extreme duskiness of the light parts of its plumage, could, I consider, only have been an example of *Corvus cornix cornix*. A short distance away was a pair of *C. c. capellanus* with which to compare it, and the difference in shade of the light parts was most marked. Possibly the single bird may have been a case of melanism of the latter species. But, in view of the fact that many European birds are winter migrants to Mesopotamia, the first supposition seems the more probable, and if correct, would mean that three races of *C. cornix* are to be found in this country, *C. c. sharpei* being the third.

The 'Fauna', I believe, accords specific rank to *capellanus*. Why, I fail to see. In size, habits, and its "caw" it is a true "Hoodie". Only in the shade of the light parts of the plumage, which is almost white, does it differ from the others. It is the only representative of the genus to be found in Busrah in summer.

The only other representative to be found throughout the year is the Rook, which arrives in October, and, in midwinter, can be counted, by hundreds, scavenging around the camps and lines.

H. A. F. MAGRATH, LT.-COL.

BUSRAH, *February* 1918.

No. III.—BLACK-HEADED SIBIA (*LIOPTILA CAPISTRATA*) IN THE JALPAIGURI DISTRICT, BENGAL.

According to the Fauna of British India this species is obtained at elevations of from 5,000 to 8,000 feet, so it is interesting to be able to record it from the plains. I got a specimen to-day at Gorumara which is about 13 miles from the foothills and at an elevation of only 300 feet above mean sea level. It was from this place that I recorded the occurrence of the Ashy Wood Pigeon (*Alsocomus pulchricollis*), so evidently round about here is a favourite place for birds recorded from fairly high elevations.

CHAS. M. INGLIS.

Camp Gorumara, Jalpaiguri,
21st January 1918.

No. IV.—OCCURRENCE OF THE WHITE-TAILED BLUE ROBIN (*NOTODELA LEUCURA*) IN THE BUXA DUARS DISTRICT, BENGAL.

While staying with my friend Mr. E. O. Shebbeare, I.F.S., I got a male of this species to-day at Jamguri, which has an elevation of about 300 feet and is about 13 miles from the foothills. In the Fauna of British India, Oates gives it as "found from about 4,000 to 9,000 feet"; so this is unusually low for it to occur.

CHAS. M. INGLIS.

Jamguri, Buxa Duars,
5th January 1918.

No. V.—AN ADDITION TO THE INDIAN LIST OF BIRDS.

I have to record the occurrence of the Corn-Bunting, *Emberiza miliaria* in the Jhang district of the Punjab. The species is not included in the volumes on birds in the 'Fauna of British India' series, and there appears to be only one previous record of its supposed occurrence within our borders. This record, relating to Sindh ('Stray Feathers,' vii, 114), was, however, not accepted by Hume.

On 20th November 1917, I came upon a flock of some twelve to fifteen Corn-Buntings near Massan, between the Jhelum and Chenab rivers. They were feeding on waste ground, covered with bushes of desert types, near water on the edge of cultivation. I secured a female; it was a little fat and weighed 1⅝ oz.; there were grains of rice in the gullet.

On the 22nd December, a party of 3 Corn-Buntings was observed (and one obtained) in the same locality by Lieut. C. B. Ticehurst, M.B.O.U., who was spending a short spell of leave camping with me.

HUGH WHISTLER, F.Z.S.,
Indian Police.

Jhang, Punjab,
30th December 1917.

No. VI.—SOME FURTHER NOTES ON CUCKOOS IN MAYMYO

When up in Maymyo this year in April and May, I was lucky enough to find a good many Cuckoo's eggs myself and to see several others which were found. My notes may be interesting as an appendix to Mr. B. B. Osmaston's notes, which appeared on page 359, of Volume XXIV of the Society's Journal.

1. Common Cuckoo, *Cuculus canorus*. I found two eggs myself, both in nests of Marsh Warbler, *Megalurus palustris*. Both are of the same type, elliptical, and slightly pointed at one end: very little gloss; ground colour, very light stone, with irregular blotches, spots, and streaks of a light reddish brown, and underlying (subsurface) markings of dull reddish grey. The markings are scanty at the small end, but form a rough ring at the large end.

The dates and other details are:—

c/1. ex *M. palustris* (c/3) 2-5-17. ·91″ × ·64″ Fresh.
c/1. ex *M. palustris* (c/4) 3-5-17. ·88″ × ·65″ Fresh.

Mr. J. C. Hopwood obtained two more eggs, both in the same piece of marsh (which is quite small) both ex *M. palustris* and similar to mine in size, shape and markings about May 10th. It is likely that these four eggs were laid by the same bird.

Mr. Hopwood and I found a young *C. canorus*, nearly fully fledged in a nest of *M. palustris* on the race course on 25-5-17. In all, we found 10 nests of *M. palustris*. Of these, 5 contained no Cuckoo's eggs, but one of these was destroyed by rats: the other 5 are noted above. This gives a mortality among the new generation, of 60 per cent. before they are even hatched. Allowing that we may have failed to find the best hidden nests, it seems that the bird must have some difficulty in getting a brood off.

These Maymyo eggs are all different from the other *C. canorus* eggs in my collection; of these two are blue, from the North Chin hills, and measure ·92″ × ·71″ and ·88″ × ·69″. The other four are from the collection of the late P. W. Mackinnon; and the markings are more indefinite: 3 are distinctly reddish speckled with brown, and one is stone coloured, speckled with grey and brown.

Their details are:—

c/1. no fosterer given: Masuri, 13-6-88. (91″ × ·69″).
c/1. ex Upland Pipit: *Oreocorys sylvanus* (c2 young birds) ·88″ × ·70 (evidently an addled egg).
c/1. ex Upland Pipit, *Oreocorys sylvanus* (c/2): 24.5.91″, Mussoorie ·91″ × 70″.
c/1. ex Crested Bunting, *Melophus melanicterus* (c/3): Tehri Garwhal, 19-5-90. ·95″ × ·73″.

My Maymyo eggs are less broad than either the Chin Hills, or the Indian eggs in my collection. One of Mr. Osmaston's Maymyo eggs apparently resembles mine, and one resembles the Indian eggs in size.

Mr. P. F. Wickham took an egg of the ordinary type from a nest of *Anthus rufulus*, and a blue *C. canorus* egg whose fosterer I cannot remember.

2. Large Hawk-cuckoo, *Hierococcyx sparverioides*. I took 5 nests containing eggs of this Hawk-cuckoo. One on 28-5-17 was a very pleasant find, as it defeats even Mr. Osmaston's "surprise-packet" in the number of Cuckoo's eggs in one nest. The nest belonged to *Garrulax monliger*, but contained only one egg of this bird, which was punctured. There was one egg of *H. sparverioides*. a long thin egg, measuring 1·31″ × ·79 and no less than four eggs of the Red-winged Crested Cuckoo, *Coccystes coromandus*, (1·13″ × 91,″ 1·06″ × ·88,″ 1·03″ × ·86″ and 1·03″ × ·86″. The last 3 eggs are very like each other and may have been laid by the same bird. All the eggs were fresh. If all the eggs had hatched, it would be interesting to know what would have happened.

The puncture in the Necklaced Laughing—Thrush, *G. moniliger*, egg was probably made by the bill of one or other of the Cuckoos in trying to eject it. The same thing was noted in several nests.

All the other eggs found were in nests containing an egg of *C. coromandus*.

Details as follows:—

15-5-17 1·22″ × ·83″ (with 1. *C. coromandus*, ·97″ × ·85″, and
(two *G. pectoralis* : all slightly set.
13-5-17 1·18″ × ·84″ (with 1. *C. coromandus*, ·97″ × ·85″, and
(3 *G. moniliger* : set.
14-5-17 1·24″ × ·84″ (with one *C. coromandus*, 1·11″ × ·86″, and
(3 *G. moniliger* : slightly set.
23-5-17 1·16″ × ·80″ (with 1. *C. coromandus* 1·02″ × .81″, and
(2 *G. moniliger* : fresh.

All the eggs were blue, 4 a little, and one considerably lighter than eggs of *G. moniliger* : except the egg found on 28-5-17 which was very long and thin, all were of the usual shape. All are glossy. There are no eggs with the very light blue colouring which two of my Chin Hills eggs have : The details of 7 eggs found in the Chin Hills are as follows:—

1·29″ × ·83″ : at 4,500.′ 24-4-14 ex MaClelland's Scimitar Babber *Pomatorhinus macclellandi* (c/3) : very light blue, fresh.
1·27″ × ·85″ : at 4,500′ 28-4-14 ex Ashy Laughing-Thrush, *Ianthocincla cineracea* (c/2): slightly set: colour, rather light.
1·26″ × ·84″ : at 4,500′ 20-4-14 ex *Pomatorhinus macclellandi* (c/2) : hard set : colour, normal.
1·26′ × ·82″ : at 5,000′ 24-4-15 ex *P. macclellandi* (c/1) : fresh : colour, very light.
1·28″ × ·88″ : at 4,500′ 3-5-15 ex *I. cineracea* (c/2) : hard set : colour, rather light.
1·14″ × ·83″ : at 5·500′ 6-5-15 ex *I. cineracea* (c/2) : fresh : normal colour.
1·20″ × ·81″ : at 4,000′ 10-5-15 ex *I. cineracea* (c/2) : fresh : colour normal but very little gloss. Is rather like *C. coromandus* in texture.

The average of 12 eggs, is therefore, a little over 1·23″ × ·83″ ; the length varying from 1·14″ to 1·31″, and the breadth from ·79′′ to ·88″. Mr. Hopwood found a nest containing 1. *H. sparverioides*, 2. *C. coromandus* and 3. *G. moniliger* eggs, all fresh, in Maymyo this year, about May 15th.

3. Red-winged Crested-cuckoo, *Coccystes coromandus.*

Four nests were found containing these eggs (apart from those mentioned above) in nests also containing *H. sparverioides* eggs as well :

1·09″ × ·85″ on 15-4-17 ex *G. moniliger*. c/2 : fresh.
1·11″ × ·90″
1·05′ × ·88″ } on 14-5-17 ex *H. pectoralis*, c/3. slightly set.
1·13″ × ·83′
1·07″ × ·92″
1·09″ × ·85″ } on 29-5-17 ex *G. moniliger*, c/3 : slightly set.
1·08″ × ·87″
1·03″ × ·88″
1·07″ × :82′ } on 22-5-17 ex *G moniliger*, c/2 : set.

Only one nest contained one Cuckoo's egg only. That was the first one found and was absolutely fresh. More might have been laid had I left the nest for a day or two, as I always did subsequently.

The average size of my 17 Maymyo eggs is 1·06″ × ·86″, and they vary in length between 1·13″ and ·97″, and in breadth between ·92 and ·81”

They run slightly smaller than Mr. Osmaston's eggs, in length, and very considerably so in breadth. His 10 eggs average 1·075″ × ·93″. My four Indian eggs are 1·06″ × ·98″, 1·14 × 96″, 1·05″ × ·03″ and 1·07″ × ·91″.

The first three are from the Khasia Hills, and the last is an ovary egg from Mussoorie. My series this year appears to be considerably smaller than usual.

Of 15 nests of *G. moniliger* and *pectoralis* found, 11 contained Cuckoo's eggs, and rats or crows took the eggs out of two of the rest. This means a loss of 13 out of 15 nests, 14 per cent. being all that run any chance of successfully hatching out, unless the Cuckoo's eggs were addled: in all but one nest, two or more Cuckoo's eggs would have to be addled. It seems extraordinary that the Laughing-Thrushes do not rapidly disappear under such adverse conditions.

For some reason, no Cuckoos appear to patronise the White-browed Laughing-Thrush, *Dryonastes sannio;* we found about 20 nests of this between us, and kept one or two under observation, but they were never interfered with. Possibly the Cuckoos do not like facing the thick raspberry brakes in which the nests are generally built. In connection with *D. sannio,* of the nests found this year about half contained white eggs, and half blue; the full clutch was 3 or 4—more commonly the latter. Mr. Hopwood tells me that when up in Maymyo with the late Col. H. H. Harington about 10 years ago, white eggs were much more common than blue, and a 4-clutch was a variety. Possibly the reason may be connected with the weather (the season was rather late and dry). Notes taken in future years will be interesting. They may show that the bird is turning into a layer of blue eggs. Of the 31 eggs of *D. sannio,* of which I have notes, the average size is 1·01″ × 76″; the length varies of from ·94″ to 1·09″ and the breadth from ·70″ to ·80″

J. M. D. MACKENZIE, M.B.O.U., F.Z.S.

PROME,
9*th December* 1917.

No. VII.—OCCURRENCE OF THE EUROPEAN GREAT BUSTARD *OTIS TARDA*, NEAR PESHAWAR.

It may interest you to know that I have had a specimen of the Great Bustard brought in to me. Hume and Marshall state that this bird has only once been obtained in the Indian Empire, but five or six years ago a good many came here and this year now that this one specimen has been obtained, there will probably be more. This one is a male and appears to be quite typical with french grey head and neck, the top of the head French grey and the breast and under body a pure white, the only way in which it differs from the illustration in Hume and Marshall being that the black and brown feathers seem to come slightly further up the back of the neck than in the illustration. It measures 83″ across the wings (not fully extended), 43″ from toe to beak, wing 39′, tail from vent 10′, tarsus 6′, foot 3·25″, width 3-45″, beak lavender, weight 14 lbs. It is probable that more will be obtained and if you would like to have it I may be able to send you a skin if I can get one in good condition.

G. ROOS-KEPPEL.

PESHAWAR, 1*st December* 1917.

[In the cold weather of 1910- a number of Great Bustard appeared in N.-W. India. Some were obtained near Mardan, one at Jacobabad, Sind, and another in Chitral. Sir George's specimen appears to be a female from the weight.—EDS.]

No. VIII.—THE WHITE-NECKED STORK IN THE PUNJAB.

In the 'Fauna of British India' Birds, Vol. iv., p. 871, there occurs the following statement with regard to the White-necked Stork, *Dissura episcopus* (Bodd.). "Except in the Punjab and Sind (where, however, a solitary specimen was once obtained), this Stork appears to occur almost throughout the well-watered plains of India, Ceylon, and Burma." The inference to be drawn from this statement obviously is that the White-necked Stork does not occur in the Punjab, but this inference is so far removed from fact that it may not be out of place to set on record some notice of its occurrence and status in this province.

To begin with, Blewitt had already shewn that the species occurred at Hansi; he states ('Humes' Nests and Eggs of Indian Birds, 2nd ed., p. 268):—"I found several nests of this species in the neighbourhood of Hansi during the latter half of June and the early part of July. They were all placed on peepul or burgot trees, mostly in the neighbourhood of the canal, and at heights of from 20 to 25 feet from the ground. They were densely built of kikur and ber and sheeshum twigs, and thickly lined with straw, leaves, and feathers. They varied from 14 to 17 inches in diameter, and from 4 to 7 inches in depth."

"Four was the largest number of eggs found in any nest, and, as in more than one instance when this number was found, the eggs were more or less incubated, this would seem to be the normal complement."

About the same locality on a Canal Bank near Hansi I found a nest of this Stork on 8th July 1914. To quote from my diary:—

"I found a White-necked Stork sitting on a large untidy stick nest placed in a side bough of a large Shisham. The bird sat close and when disturbed kept on flying round, returning as soon as I left the tree; from the clucking noise, when the bird moved, it was evident that the nest contained young. However I sent a man up to examine and secured 3 very stained and addled eggs with a nestling. The latter was apparently about a week old, so I kept it with a view to rearing it if possible."

This chick was described as follows:—

The skin plumbeous in colour; on the crown extending from the forehead, which was covered with white down, to the level of the ear orifices a thick growth of black decomposed feathers with a blue gloss. The facial skin and pouch sparsely, the nape and neck all round thickly, clothed with white down.

Entire upper parts, lower neck and breast covered with sooty coloured down, with minute grey tips. Flanks, sides of abdomen, and underside of tail covered with white down.

Iris hazel. Bill brownish black slightly tipped with orange yellow, the latter colour broken by a brownish black bar. Legs fleshy plumbeous speckled most closely on the feet with dark brown. Claws fleshy yellow.

Eyelids plumbeous black. Facial skin and pouch plumbeous grey, the latter tinged with green.

The chick was reared successfully on frogs, small fish, insects, and raw meat soaked in water and made a most amusing pet; it lived loose in the compound until it was killed one night by a dog or jackal.

The species is certainly common and probably resident at Hansi; it is found throughout the remaining parts of Hissar district, including Sirsa. and may be observed throughout the year although varying somewhat in numbers. I have once seen a couple standing on the domed roof of a mausoleum at Hissar, but for the most part this Stork is to be seen standing wrapped in meditation on the ground or feeding with other storks and

Ibises on fields flooded with canal water. While occasionally solitary, it is usually to be seen in small parties of four or five to a dozen individuals.

In the neighbouring district of Ferozepore I cannot recollect seeing the species, but I have the following notes on its occurrence in certain districts of the Punjab :—

Ambala district, 1915-16. A favourite resort of this species was the Ghaggar nala close to where it debouches from the foot hills about Chandighar; here I found a large flock resting in the nala about noon on 10th November, and many individuals, including a party of 11, when I was there again in February and March. It also appeared to be sparsely distributed through the district during the winter months. I was not there in summer.

Gurdaspur district, 1915. Two were seen near Gurdaspur on 13th June.

Lahore district. Mr. A. J. Currie writes (Jour. B. N. H. S. xxiv, 576) "I have seen this stork at Lahore in September, and on one or two other unrecorded dates in the cold weather."

Gujranwala district, 1915. "One was seen from the train between Gujranwala and Kamoke on 29th March. One was seen on some flooded rice fields in Gujranwala on 5th July. Two were seen from the train near Akalgarh on 3rd October, soaring in the sky with some vultures." (Jour. B. N. H. S. xxiv, 709).

Jhelum district, 1914. "Two were seen at Saugor on the 1st of February and 2 (possibly the same) flying down the river near the Rak at Jhelum on April 12th" (*Ipse* Ibis, 1916, p. 113).

Jhang district, 1917. On 19th November two birds and then a solitary individual were seen near Chund Barwana, and on 25th December a nest was found in my presence by Lieut. Claude B. Ticehurst, M.B.O.U.

This nest was situated on the extreme summit of a lofty Keekur tree standing by the side of a small half dry Jheel about 5 miles S.-W. of Kadirpur. The nest was a flat structure of large sticks, plentifully bespattered with whitewash, and said by the climber to be lined with grass. It contained 4 eggs. One bird was sitting on the eggs and the other standing on or near the side of the nest. There were some Black Storks (*Ciconia nigra*) feeding on the Jheel, but neither their departure nor the excitement consequent on the flying of a trained Shahin Falcon at a Pond Heron disturbed the pair. When they were finally roused one bird flew away but the other kept on circling round and settled on a neighbouring tree, clattering her bill at the approach of one of the members of our party.

The White-necked Stork does not yet appeared to have been recorded north of the Salt Range or from the North-West Frontier Province. While further details of its range and status in the Punjab are desirable, enough has been said to shew that the species may be considered by no means uncommon in the province; it would, however, be interesting to know if this is a recent extension of range connected with the gradual transformation of the country by the various canal projects.

JHANG, PUNJAB,
Jan. 1918.

HUGH WHISTLER, M.B.O.U., F.Z.S.,
(Indian Police).

No. IX.—COMB DUCK (*SARCIDIORNIS MELANONOTUS*) IN SIND.

I write to record the occurrence of a Nukhta or Comb Duck, *Sarcidiornis melanonotus*, in Sind.

On the 15th instant I was shooting on a jheel near Rajo Khanani in the extreme north of the Tando Bago taluka of this district. I saw a duck which seemed strangely familiar in flight at some distance and as it came nearer, I saw it to be a male comb duck. I had a couple of long shots at it, but unfortunately failed to get it. But I am quite certain of its identity as I have seen and shot a good many in the Kaira district where it is common. It was apparently in full plumage and the comb on the bill was very evident. I expected to see the female about but only the male was on the wing. I asked the local "Mohanas" what the duck was and they said they did not recognise it, but thought it must be a foreigner.

The jheel was a low hollow formed out of old flooded rice fields and the only cover was afforded by "pan" or the common bull-rush reeds, with a fair amount of open water in the middle.

I see from page 24 of "Indian Ducks and Their Allies" that Hume speaks of it as "a mere straggler to the easternmost portions" of Sind.

R. E. GIBSON, I.C.S.

CAMP, *via* HYDERABAD, SIND,
19*th February* 1918.

No. X.—A FEW NOTES ON THE NESTS AND EGGS OF SOME OF THE BURMESE SCIMITAR BABBLERS.

When writing his notes on the Indian *Timeliides* and their allies (J., B.N.H.S. Vol. XXIII) the late Col. H. H. Harington asked me for nesting notes on some of the Burmese species of *Pomatorhinus*; at the time I could not give him any information, but I have since found nests of 3 species and subspecies, Grant's Slaty-headed Scimitar Babbler, *Pomatorhinus schisticeps mearsi*, Shan States Scimitar Babbler, *P. olivaceus ripponi*, and Tweeddale's Scimitar Babbler, *P. nuchalis*, notes on which may be of interest.

The eggs are, of course, all white, and of what appears to be the usual shape, gloss and texture for this part of the subfamily. Those of the 3 subspecies which I have taken are indistinguishable from each other in these respects. The shells are fine-grained and rather thin and fragile, especially when compared with eggs of White-browed Laughing-Thrush, *Dryonastes sannio*, of which I was taking some clutches at Maymyo at the time when I found *P. o. ripponi*. In this, I have found some difference between these eggs and those of MacClelland's Scimitar Babbler, *P. erythrogenys macclellandi*, which are not only bigger but have comparatively stouter shells. In shape, the eggs of this last species are generally less pointed; my eggs of *P. s. mearsi*, *P. o. ripponi* and *P. nuchalis* are all considerably pointed at the small end while the greater number of my series of *P. e. macclellandi* are distinctly obtuse as are those of Phayre's Scimitar Babbler, *P. ferruginosus phayrei* in a smaller degree: all my eggs of this group are glossy.

The nests of the three Scimitar Babblers bear a close family resemblance, both to each other, and to those of Baker's Rufous-necked Scimitar Babbler, *P. ruficollis bakeri*, *P. e. macclellandi*, and Phayre's Scimitar Babbler, *P. ferruginosus phayrei*, all of which I have taken several times in the North Chin hills. They are domed, built rather untidily of bamboo leaves, lined with grass and fibres. As far as I remember, I have only found two cup-shaped nests, and in both cases the dome was replaced by an overhanging tuft of grass. One of these was *P. e. macclellandi*, the other *P. r. bakeri*. All the other nests were domed although the roof was sometimes rather a flimsy affair.

(1). *Pomatorhinus schisticeps mearsi*—(116*a*) Grant's Slaty-headed Scimitar Babbler. Upper Chindwin, about 40 miles North of Kindat. Found 2 fresh eggs on 21-4-14 which I had to take as I was moving camp next day. Size 1·02″ × ·78″, and 1·06″ × ·78″. The nest was placed in a clump of dead bamboos, about a foot from the ground.

Mr. J. C. Hopwood found another nest near Kindat on 27th March 1907 in a hollow on the ground, containing 2 fresh eggs, similar to mine.

(2). *Pomatorhinus olivaceus ripponi*—(118*a*) The Shan States Scimitar Babbler. Maymyo, 3-5-17, nest with 3 fresh eggs, one of which was unfortunately broken in blowing. The nest was placed on the ground, among dead bamboo leaves. Eggs ·95″ × ·70″, and ·96″ × ·69″. Mr. Hopwood found a nest in a similar situation containing 2 fresh eggs on 9th May 1917. His eggs measured about the same as mine.

Mr. B. B. Osmaston found a nest in 1916 about the middle of October, containing 3 hard set eggs. This seems to indicate that the bird is sometimes at any rate double-brooded.

(3). *Pomatorhinus nuchalis*—(117) Tweeddale's Scimitar Babbler. Prome, 24th July 1917. I found this nest the evening before, containing two eggs. On returning on the 24th, I shot the bird to put its identity out of question but the nest only contained one egg, measuring ·95″ × ·74″. The nest was the usual domed structure but with its long axis horizontal, not vertical, placed in a bamboo clump, supported by 3 culms about 4′ 6″ from the ground. It was on a little used path, on the edge of a patch of bamboo jungle, where it joined a 'Pônzô' or piece of abandoned hill cultivation. It was raining hard at the time when I took it, but the nest was apparently waterproof, as the egg was dry.

(4). *Pomatorhinus hypoleucus hypoleucus*—(131) The Arracan Scimitar Babbler. Upper Chindwin, 2 fresh eggs, in December 1913. The nest was in a thick bamboo clump, about 2 feet from the ground.

Mr. J. C. Hopwood took a nest on the Arracan Yoma on 26th January 1909 in dense bamboo jungle. He has kindly permitted me to quote from his notes: "A domed cup, measuring 13″ × 7″ outside, and 3″ × 3″ inside. Foundation of dead bamboo leaves, the nest itself of the twigs and tendrils of a creeper, cup thickly lined with roots and fibres of fern, placed in the twigs of a broken bamboo. Two fresh eggs, measured 1·29″ × ·86″ and 1·30″ × ·88″.

Mr Hopwood found another nest near Kindat, in a cane brake in January or February, similar to this one.

(5). *Pomatorhinus ferruginosus phayrei*—(124) Phayre's Scimitar Babbler. Chin Hills. 3 or 4 nests taken, 24-4-14 and 10-5-15. Average size of 6 eggs, ·98″ × ·72″.

(6). *Pomatorhinus ruficollis bakeri*—(125*a*) Baker's Rufous-necked Scimitar Babbler. Chin Hills. Taken 13-5-13 (2 nests), 25-4-14. Average size of 6 eggs ·87″ × ·66″.

(7). *Pomatorhinus erythrogenys macclellandi*—(130) McClelland's Scimitar Babbler. Chin Hills. Taken 6-5-13 to 16-5-13 (10 nests). Average size of 30 eggs, 1·02″ × ·76″.

It is invariably a very dangerous thing to generalise, especially with insufficient material and I do so with great diffidence. Judging from the small series of these eggs to which I have had access, it seems that the family divides itself "Oologically" into two groups, the first (*P. s. mearsi*, *P. o. ripponi*, and *P. nuchalis*) laying pointed eggs with thin and fragile shells, the second (*P. f. phayrei*, *P. h. hypoleucus*, *P. r. bakeri*, and *P. e. macclellandi*) laying eggs which are generally more obtuse, and have both actually and comparatively thicker and stouter shells than the first group. The second group appears to contain the larger birds of the group but the difference in eggs does not appear to coincide exactly with the difference in the bills among the birds of the sub-family as noted in Oates, F. B. I.

P. h. hypoleucus is aberrant in laying in the cold weather. Of the others *P. o. ripponi* is certainly, and the remainder are possibly, sometimes if not always double-brooded; with regard to the nests, they appear to be almost invariably domed, while each species seems to stick to one situation in which to build. *P. s. mearsi* builds on the ground (my nest found on a clump of dead and broken bamboos was practically on the ground) as do *P. o. ripponi, P. r. bakeri, P. f. phayrei* and *P. e. macclellandi*, while *P. muchalis* and *P. h. hypoleucus* build in bamboo clumps 2 to 5 feet above the ground. All these facts want further proof.

J. M. D. MACKENZIE, I.F.S., M.B.O.U., F.Z.S.

PROME,
28th Dec. 1917.

No. XI.—MISCELLANEOUS NOTES ON SOME BIRDS IN THE CHIN HILLS, BURMA.

In 1916 I was touring in the Chin Hills (Latitude 23°) during April and the beginning of May and made the following notes which may of interest.

I was fortunate in discovering a new species of *Larvivora* the description of which as described by Mr. Stuart Baker in "Novitates Zoologicæ," Vol. XXIII, page 288, September 1916, I enclose.

This bird was obtained by me on the 1st May on the march from Fort-White, Chin Hills, to the plains, the nest was situated on the cleared space above the actual side cutting of the hill side mule track; at this place the cutting was about 4 feet high. The nest was placed under a dried bracken leaf bent down, made of leaves, moss and lined hair, the parent bird fluttered off as I came near, into the jungle below the path, but waiting for it I secured it on its return which the bird soon did. The white legs drooping as it flew away off the nest were most conspicuous.

Unfortunately I did not reach my Camp till dark when failing to identify the bird I had to skin it by candle light and failed to sex it—the nest contained 4 eggs of a greenish blue colour. I also secured 2 nests and the parent bird of (13) Yellow-billed Blue Magpie, *Urocissa flavirostris*. Mr. Stuart Baker says of this bird "it differs from the more Western form in several particulars which may however be only individual." I believe, however, this is the first record of this bird in Burma.

Other birds obtained and nidification of some are recorded below, together with some recorded from the Mount Victoria part of the Chin Hills in 1917.

Ashy Laughing-Thrush, *Ianthocincla cineracea* (79). C/2—28th April and young, bird shot.

McClelland's Scimitar Babbler, *Pomatorhinus maclellandi*—(130). C/5, 25th April. Bird shot and identified.

Rippon's Bar-wing, *Actinodura egertoni ripponi*—(211*a*). C/3, 24th April.

Grey Sibia, *Lioptila gracilis*—(205). C/2, Bird shot, common and noisy enough to be almost a nuisance.

Orange-barred Willow-Warbler, *Phylloscopus pulcher*—(414). C/3, 13th April and C/4, 24th April; the former contained an egg (·84 × ·56) white with a few red spots at the large end of *Cuculus saturatus*; Bird identified in England by Mr. Stuart Baker; common.

Brooks's Grey-headed Flycatcher Warbler, *Chryptolopha jerdoni*—(435). C/4, 19th April. Bird shot.

Indian Skylark, *Alauda gulgula*—(861). At 9,000 feet elevation in the short grass of the wind swept bare top of the Kennedy Peak ridge, the highest point of this part of the Hills. C/3, C/3 Fresh C/3, just hatching and one nest with young, 26th April.

Dimensions of bird shot were length 6·5″, tail 2·4″, wing 3·6″, tarsus ·8″, bill from gape ·6″, flank stripes present, but few.

Gennaeus horsfieldi williamsi.—C/6, obtained near Tiddim; the parent bird was unfortunately not obtained. I gave 3 eggs to Captain Blandy of the Military Police who kindly undertook to try and hatch them out under a hen. One hatched and lived for a week or two, enough to show he told me white on the wing coverts which makes me think my nest might have been Mrs. Hume's Pheasant, *P. humii*, but the eggs are "Kalij" and the finder told me, the bird had a crest which the female of *P. humii* has not.

Mount Victoria, part of Chin Hill (Latitude 21°), 1917.

Ashy Laughing-Thrush, *Ianthocincla cineracea*—(79). C/2, 25th April.

Mt. Victoria Babbler, *Babax victoriæ*—(81). C/2, 27th April.

Skin kindly identified for me by the Society who have it in their collection.

Shan States Scimitar Babbler, *Pomatorhinus olivaceus ripponi* (?)—(118). C/3. Fresh, 25th April.

I missed this bird off the nest, but obtained a species almost on the same spot off the nest some years ago and identified it then.

Mandelli's Tit-Babbler, *Shæniparus mandellii*—(179). C/2 Fresh. 26th April.

Blyths' Bulbul, *Xanthixus flavescens*—(287). C/3 Fresh. 22nd April, bird shot.

Finch-billed Bulbul, *Spizixus canifrons*—(292). C/2, 26th April. This is a late date for this bird, they mostly had young.

Mt. Victoria tailed-Wren, *Urocichla oatesi*—(355 *b*). C/2 Fresh. Nest brought to me by a Chin woman 28th April.

Burmese Scarlet Minivet, *Pericrocotus fraterculus*—(491). Nest inaccessible, bird sitting 24th April. Just 12 years before I found a nest being built almost, if not, in the same tree near an Inspection Bungalow, but the Ghoorkha Durwan did not then get me the eggs. Same pair of birds?

Eastern Slaty-blue Flycatcher, *Cyornis leucomelanurus cirreniventris*—(567*a*). C/3, 25th April. Female kindly identified for me by the Society who have the skin—the Eastern variety of *Cyornis leucomelanurus*.

Eastern Spotted Forktail, *Henicurus guttatus*—(631). C/3. Parent bird shot; the nest was lined with the skeletons of leaves.

In both years the nests and eggs of the following were common during the month of April in these hills.

Dark-grey Bush-chat, *Oreicola ferrea*—(615).

Chestnut-bellied Rock-Thrush, *Petrophila erythrogastra*—(690).

Rufous-bellied Niltava, *Niltava sundara*—(594).

Verditer Flycatcher, *Stoparola melanops*—(579).

Eastern Slaty-blue Flycatcher, *C. l. cirreniventris*—(567). The four latter all in holes on the roadside cuttings. I also shot the following on the Mt. Victoria side.

Striated Green Bulbul, *Alcurus striatus*—(277).

Slaty-bellied Short-wing, *Tesia cyaniventris*—(201).

Chestnut-headed Short-wing, *Oligura castaniacoronata*—(202).

RANGOON, *Jan.* 1918. P. F. WICKHAM, P. W. D.

No. XII.—CLOSE-BARRED SANDGROUSE AT MUSCAT.

Owing to the disturbed state of the country we are unable to go beyond our out-post line, so that there is only a very limited area to observe the Close-barred Sandgrouse in. We came here in January 1916, and the birds were here then, they were only in small numbers, and one very seldom flushed more than six or eight birds at once. They were feeding on the seeds of a shrub, which is, as far as I can recollect the same as what we call "bastard Indigo" in India. From about the 1st April, very few birds remained here and the last two days I looked for them I only put up four birds. They seemed to have paired then, but I found no eggs and I fancy they migrate to the higher ground in the interior, anyway from the middle of April till now, I have neither seen nor heard of any birds in the valley or hills accessible to us.

From what I heard from the officers of the regiment we relieved, these sandgrouse arrive here in September or October, but I will make a careful search of the whole valley and let you know the result.

The only other Sandgrouse I have seen here is the pintail—the same bird one gets in India. They were here from early February to about the middle of March—one always saw one or two large flocks of them in the Valley—they left some three weeks before the Close-barred Sandgrouse disappeared. If we are still here when the birds return I will get you a few more specimens of both sexes. The female is very different in plumage to the male.

Since writing the above I have satisfied myself that there are no Sandgrouse in the limited area available for search here and am convinced they migrate from the Coast of Oman in April. They probably move to the elevated plains in the interior of Oman to breed.

A. R. BURTON, MAJOR,
94th Russell's Infantry.

MUSCAT, ARABIA,
15*th July*, 1916.

[We greatly regret to learn of the death of Major A. R. Burton some few months ago. Major Burton helped our Soceity in many ways and sent the museum many interesting specimens from Muscat and other places.—EDS.

No. XIII.—THE SPAN OF LARGE BIRDS.

In reference to the correspondence in the Society's Journal on "The Span of Large Birds," the following figures measured by myself from fresh-shot specimens in the flesh may possibly be worth putting on record :—

	Ft.	ins.
Shoebill, *Balæniceps rex*, Bahrel Ghazal, Sudan, March 1900 ..	8	6
Marabou Stork, *Leptoptilus crumeniferus*, Kaka, Sudan, March 1900..	8	4
Black Vulture, *Otogyps calvus*, Kedha, Malay Peninsula, May 1898..	7	5
Indian White-backed Vulture, *Pseudogyps bengalensis*, Kedha, Malay Peninsula, May 1898..	7	1½
Pallas's Fishing Eagle, *Haliaëtus leucoryphus*, Jalhopur, India, December 1894..	6	7
Do. do. do. do. Dhorahra, India, February 1895..	6	5
White Nile Crane, *Balearica ceciliæ*, Abu Zeit, Sudan, March 1900.	5	8
White-necked Stork, *Dissura episcopus* Harrowah, India, Dec. 1894..	5	9
Do. do. do. do. ..	5	3
Hooded Vulture, *Neophron monachus*, Bahrel Zeraf, Sudan, March 1900..	5	6½
Smaller White Scavenger Vulture, *Neophron ginginianus*, Harrowah, India, Dec. 1914..	5	3
Do. do. do. do ..	5	1
Do. do. do. Chunar India, Nov. 1894..	4	9

	Ft.	ins.
African Open-bill, *Anastomus lamelligerus*, Abu, Zeit, Sudan, March 1900 ..	4	9
Brahminy Kite, *Haliastur indus*, Harrowah, India, Dec. 1894 ..	4	1
Do. do. On Ganges, do. do. ..	4	1

GIZA, EGYPT,
13*th December* 1917.

S. S. FLOWER, CAPT.

No. XIV.—CAPTURING TIGERS WITH BIRD-LIME.

At page 493, Vol. XXV of our Journal, there is a note by Colonel Burton on the method of capturing tigers with hay smeared with "glue," in the days of the Emperor Akbar. He enquires whether the plan is practical.

Whether practical or not, the practice seems to have survived in the Central Provinces. In 1890-91, I was stationed at Sambalpur in the Chattisghar division of that province, and was told that the jungle people there were in the habit of getting at tigers by laying down leaves smeared with bird-lime on paths frequented by the tiger they were after. It was mostly in the hot weather they did this in the neighbourhood of water pools, but probably they did it round a kill as well.

They told me that the tiger was annoyed by the leaves sticking to his paws, and tried to rub the leaves off on his head. The leaves then stuck to the face in such numbers as to blind the tiger, which could with safety be approached and speared, while in this helpless state.

W. B. BANNERMAN,
Surgeon-General, I.M.S.

MADRAS, 13*th March* 1918.

No. XV.—ON AN UNDESCRIBED COLOUR VARIETY OF THE SNAKE (*ZAOCYS MUCOSUS*) FROM THE CENTRAL PROVINCES.

This snake, which I am inclined to regard in the light of an albino, differs from the usual colours displayed by the species and forcibly brings to mind the variety *atriceps* of *Zamenis diadema*.

Dorsally the prevailing hue is a very pale brown, slightly darker posteriorly and on the top of the head ; but paler, almost whitish anteriorly, and at first sight I took it to be an exceedingly pale coloured *Z. fasciolatus*. The under parts are white or pinkish white and practically without markings, though in some places the scales are somewhat clouded in the centre with paler margins. The line of demarcation between the pale brown of the upper parts and the white of the under parts is fairly even anteriorly but posteriorly it becomes very irregular and follows the margins of the scales. The tip of the snout from the præfrontals is intensely white and in strong contrast with the brown of the head. Several dark brown patches are disposed irregularly along the dorsum and sides of the body. Most of these patches are small, covering, sometimes part of a scale only, sometimes the complete scale, or a group of scales. The largest patch covers a group of about 21 scales. In addition to these patches of colour there are red patches also irregularly disposed, though fewer in number than the brown. In most cases the red colour is distributed over but a single scale.

Half of a ventral and a group of three subcaudals are also red.

This snake which is the only one I have seen, measures about 2½ feet in length. It was taken on a plantain tree at Nagpur in October and is at present alive in the Vivaria of the Nagpur Museum. I propose calling it *Z. mucosus* var *pallidus*, as I see no difference in lepidosis between it and *Z. mucosus*.

E. A. D'ABREU, F.Z.S.

CENTRAL MUSEUM,
NAGPUR, *6th December* 1917.

No. XVI.—NOTES ON A GRAVID *HYDROPHIS CYANOCINCTUS* AND HER BROOD.

(*With a diagram.*)

In my monograph of the Seasnakes* under the species *Hydrophis* (*Distira*) *spirates* (Shaw), and *H. cyanocinctus* (Daudin) I questioned the validity of several species described by various authors. I pointed out that many of these were merely separated from the two species above cited on characters affecting the postoculars, temporals, and supralabials, all shield subject to great variation in individuals of the same species. This variation is such that these shields are in my opinion not even an aid in the separation of species, and certainly too insecure as the basis for describing species.

This was merely an opinion, and one that is open to anyone to contest. It is obvious that anyone might contend that the individuals upon which I based my opinions were not of the same species. This being so the most convincing means of establishing the truth of my contention is to subject a gravid female and her unborn brood to critical examination. There can be no doubt in such a case that the specimens are of one species.

It is not often such a specimen comes into my hands, but one such I reported upon in this Journal (Vol. XX, p. 858) the subject being a *spiralis* (Shaw).

I have now obtained through Dr. Malcolm Smith from Siam a gravid *cyanocinctus* (Daudin), and the information derived from an analysis of the lepidosis of dam and brood forms the subjects of this note. I append outline drawings of the head of the mother, and two of the brood, (Nos. 2 and 7 of the synopsis). I also give a synopsis of the salient features concerning these, and some other specimens to be referred to later.

It will be observed from the figures that in the dam there was but one præocular on both sides. In No. 2 there are two on the right side only, and in No. 4 two on both sides. This shield is confluent with the supraocular in No. 3.

In the dam there is one postocular on both sides, but in Nos. 2, 4, 6 and 7 there are two on one or both sides.

In the dam there is one small anterior and one larger posterior temporal, but in Nos. 6 and 7 there are two posterior temporals on both sides.

In the dam the first four labials are large, the rest small, but in No. 2 the 3rd right labial is divided to form a lower postocular, and the 4th right, and 5th left are also divided.

With the gravid female I received six foetuses that had been removed from their sacs, and two sacs in which the embryos lay coiled. Also four adults, one young specimen and the head of an adult, all without any doubt examples of the same species. All of these are included on the synopsis, and figures are given of three of them.

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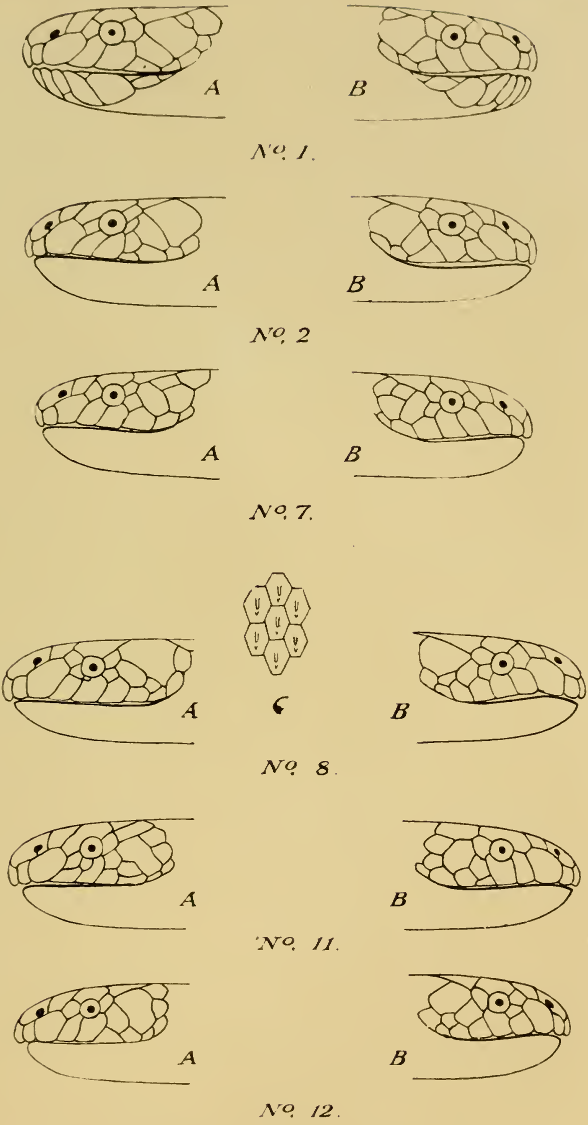
* Memoirs Asiatic Society of Bengal, 1909.


A
B
No. 1.
A
B
No. 2
A
B
No. 7.
A
C
B
No. 8.
A
B
No. 11.
A
B
No. 12.

Variation of Lepidosis of *Hydrophis cyanocinctus*.

These specimens were sent to me as *H. tuberculata* (Anderson). In my monograph already referred to, I tried to show that this "species" (at that time resting on a solitary specimen in the Indian Museum, the "type" which I had examined) was not entitled to rank as a species apart from *cyanocinctus* (Daudin). I consider these thirteen Siam specimens are *cyanocinctus* (Daudin) for the following reasons: (1) Because the numbers of the costal rows accords with the range given in Boulenger's description in his Catalogue (Vol. III, p. 295) (2) These costals have tubercles bituberculate in character, and exactly like those seen in Indian specimens of *cyanocinctus*, (figured in No. 8C). (3) The range of ventrals is well within that given by Boulenger. (4) There is nothing in the lepidosis of the head by which they can be considered distinct. (5) A critical examination of the skulls of Nos. 9 and 13, bone for bone, beside two skulls in my collection from Indian examples, show no differences that I can discover. (6) The dentition agrees with that of my Indian specimens, and is as follows—The post maxillary teeth vary from 7 to 10 (Indian specimens 6 to 10); the palatine are 7 (Indian specimens 7 to 9); the pherygoid 17 to 24 (Indian specimens 15 to 18); mandibular 17 (Indian specimens 16). (7) Further the gravid Siam specimen measured 2 feet 9 inches, and I have examined a gravid female of *cyanocinctus* (Daudin) in the Indian Museum 2 feet 11 inches in length. (8) The colouration is, as I have remarked it, in Indian specimens.

No. of the series.	Sex.	Length in inches.	Length of tail.	Costals.			Ventrals.	Bands on body.	Bands on tail.	Post maxillary teeth.	
				2 heads lengths behind head.	Midbody.	2 heads lengths before anus.					
1	♀	33	3½	32	38	37	312	50	8	7	Gravid. Contained 8 sacs with embryos.
foetus 2	♂	10	..	35	39	37	298	56	8	..	3rd right labial divided to form a lower præocular. 4th right, and 5th left labials divided. 2 postoculars on left side.
foetus 3	♀	10½	..	32	38	36	303	46	6	..	Præocular confluent with supraocular both sides, 5th left labial divided.
foetus 4	♀	10	..	33	39	36	300	45	6	..	Two præoculars on both sides.
foetus 5	♀	10½	..	33	37	37	282	46	7	..	
foetus 6	♀	10½	..	31	37	37	293	51	9	..	Two right postoculars. Two post-temporals on right side.

No. of the series.	Sex.	Length in inches.	Length of tail.	Costals.			Ventral.	Bands on body.	Bands on tail.	Post maxillary teeth.	
				2 heads lengths behind head.	Midbody.	2 heads lengths before anus.					
foetus 7	♀	10½	..	31	35	37	302	51	7	..	Two postoculars on both sides. Two post-temporals both sides.
8	?	12¼	..	31	37	37	292	56	8	..	3rd left labial divided to form a lower præocular. Two post-temporals on both sides. Two postoculars on both sides.
9	♀	30½	3	33	39	35	301	49	7	7	Two post-temporals on both sides.
10	♂	30⅞	3⅞	31	36	33	304	51	9	9	
11	♀	27¾	2¾	33	36	32	300	49	6	9	Præocular confluent with supraocular both sides. Three anterior temporals on left side. 3rd labial divided on left side into two upper, and on lower part 5th right labial divided.
12	♂	29¼	3⅞	32	36	33	290	54	11	7	3rd right labial divided to form a lower præocular. Two post temporals on right side.
13	..	..	..	..	..	..	..	..	..	10	Head only.

F. WALL, LT.-COL., I.M.S.

JHELUM, *December* 1917.

No. XVII.—NOTE ON THE BREEDING OF THE RASP-SKINNED WATER SNAKE *CHERSYDRUS GRANULATUS*, SCHNEIDER.

I have lately received from Dr. J. R. Henderson an interesting specimen of *Chersydrus* killed on the 19th of August in the timber pond, Madras Harbour (salt water).

On dissection it proved to be gravid, and contained twelve embryos in an advanced stage of development. The mother was 48 inches in length, the tail accounting for 5 inches. She was the usual colour of adults, being an almost uniform dark umber. Any lighter markings have to be closely sought for, and are then hardly visible.

The embryos unfortunately were in a very sodden condition, and broken. Four that were whole measured 12¾, 13, 13½ and 13¾ inches respectively. They could not be sexed as none showed the genitals extruded. They were chiefly remarkable for their zebra-like appearance

The body from just behind the head and the tail, were encircled with well-defined blackish-brown bands, many of which became confluent for a short space about midcosta, presenting very much the appearance of the stripes seen in zebras. The intervals were a pale buff, and rather narrower than the dark bands. The head was blackish with a few, small, whitish, symmetrically disposed spots on the crown, and a larger spot on the temporal region.

This is the first instance of which I am aware demonstrating the viviparous habit of the species.

F. WALL, Lieut.-Col., I.M.S.

Jhelum, *25th November* 1917.

No. XVIII.—NOTES ON FLIES FOR TROUT FLY FISHING IN KASHMIR.

I have been asked to write something of trout flies which may help anglers in Kashmir, and I do so with considerable diffidence for several reasons.

The catching of trout is only one of the joys of the true angler, but many are only attracted at first to the sport by some success obtained with help from a friend and it is as the friend of the would-be angler that I would approach the subject with as few technicalities as possible.

Like all pursuits of the *feræ naturæ*, success in angling calls for a good deal of personal observation. Many who have never cast a line in their lives may have noticed the position trout take when resting or feeding in a clear stream, and many others may have noticed the insects that creep or fly about the banks of such trout streams and even the seasons in which they are commonly seen without once using the knowledge so acquired. But to the true angler such observation is part of the game.

In Kashmir the seasons very closely correspond to those in the British Isles and the insects common to these seasons also closely correspond, so that there is no great difficulty in the way of the British angler when he pays a visit to this country, if he has his outfit with him.

With the neophyte, however, it is different. He arrives in Kashmir and and hears that trout are many and big in some of the streams. With a friend who knows perhaps a little more about it than he does himself, he proceeds to Lambert's or Guffaras shop and is promptly provided with a rod and reel. Cast lines which *should* stand the strain of a first strike are next selected and then boxes of phantoms, lures and flies are produced which are all guaranteed to have been successful at some time or another. With the first two, our present interest does not lie. They are made to resemble small fish and to lure old cannibals or jealous young trout to destruction. To do this successfully requires some skill, but the lures vary little with the seasons. With flies it is different. Here in Kashmir trout fishing only begins in April, so that some of the flies which are much valued in Britain for early spring fishing, such as the purple and teal, the hare lug (ear), &c., are less in demand than in England where fishing begins earlier. These flies will often kill trout, but they are not the only flies about when the hot sun comes out and the streams clear out here.

Among the daintiest of the early effemeridæ—the stone fly and creepèr have already been on the water for a month or more but are still much appreciated. A common representation of the fly is "Greenwell's glory," an artificial fly often successful all through the season. Canon Greenwell after whom the fly is named is now in his 98th year and still a keen fisher.*

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* Since the above was written we regret to say Canon Greenwell's death has been announced.—Eds.

A bright, orange coloured beetle is sometimes seen about at the opening of the season, and this is fairly well represented by the "Challoner," a fly much valued on Loch Awe, where it was introduced by an old Parson of that name fifty years ago. The red and teal and red body with the Heckham Peckham wing are both good flies in the early season, but what they resemble in nature, I have not yet found out. There are so many black flies of sorts about all the year round that it is decidedly wise to have one on the cast. Black Palmer, Zulu, black and teal, black and mallard, black and woodcock wing all have their votaries, but probably Watson's Fancy is better than any of these out here. The fly was so called by a Scotch fishing tackle maker named Watson who has advertised it, but was known years earlier on Tweedside as "the wee black deevil" and in Ireland as "the Connemara black." Another useful fly with a black wing and silver body is the "butcher". Personally, out here, I prefer this fly dressed with a feather from the blue black of a duck's wing, and thus dressed it closely resembles a small beetle which is always in great numbers on the bushes and plants of some of the streams. I have seen this beetle in nearly every month of the fishing season, and where I see it, I put the fly on. At times I have seen ladybirds in considerable numbers by the waterside, and have found the "Cock i Bhondhu" a killing fly at such times, but I have never seen the true bracken clock out here, and the fly is not always a killer. The "Soldier Palmer" is a good fly in the early part of the season, but the red palmer and the worm fly are better in May and June. Another hackle fly which I have seen do well on the Budwan stream in August is known as the dotterell, and probably like the Palmers, is taken for some kind of caterpillar. There is no doubt that when such are about, a fly which looks fairly like them in the water proves attractive.

Another spring fly with which I have had considerable success is a colorable imitation of the fresh water shrimp (*Gammerus pulex*) which Hardy dressed for me. It is a fly I do not use regularly, generally putting it on when there is not much doing, and this may be the reason I have caught trout in rather poor condition when using it.

With warmer weather a lot of flies with green and yellow bodies hatch out, and there are times when trout will hardly look at anything else. As to the shade of body and wing to be used, one has to be guided a good deal by the flies one sees. Probably the best all round green fly is the green and woodcock wing, but the teal wing comes very near it. At times I prefer the blue or the mallard wing and the heckham peckham wing also has it's day. When the green flies are really about, I have occasionally fished green bodies only with different wings and hackles, and have been satisfied with the result. The great green beetle comes out in June, and the Moonal imitation can at times be very effective.

One of the best flies from the beginning of the season is the blae wing and blue body, though there are days later on when the old blae and black is equally effective. I have also found a bright little Zulu useful in May, but it is not a certain killer. Yellow bodied flies seem specially attractive in streams which come through a forest country, and this is no doubt due to the presence of one specially fat bodied fly which is rather a heavy flier and often comes down on the water from overhanging branches. A dark mallard or dark teal wing most closely resembles that of the fly, but the woodcock wing seems to serve the purpose, and may possibly, from the trout's point of view, be more like it. The March brown is probably the best known fly in the British list, and out here all the various dressings including the Irish variation, the Invicta, at times kill well. In saying this, I should remind the reader that I am dealing with wet flies only, and that these dressings are accepted chiefly because they represent a fly or creeper for which the fish are looking at the time it is presented to them. There are times on our lakes and quieter pools when trout may be seen greedily taking a floating fly when they will not look at a wet one. At these times a dry fly fisher would score heavily, but these occasions do not come so fraquently as they do at home and the day has not come yet when the close study required for success with the dry fly, is necessary to the acquisition of a full creel. Observation, however, can make a big difference. Another point that helps much is the size of the fly. Most neophytes use flies much larger than the natural insects, and when the water is big or a little thick this sometimes gives good results, but when the water is clear, fine trout are becoming more discriminating, especially on waters that have been much fished, so that the nearer to nature one can get the better.

As the season advances, flies with a peacock harl body seem to become more attractive. The alder is the earliest of these, and is most effective when well sunk. Hardy's Favourite is a modification of this fly which is often very successful. The Coachman is, perhaps, one of this most successful flies after June, and is useful much earlier, in the evening. With June also the big sedge comes out in numbers, and from that time onward the cinnamon wing is distinctly useful. A Wickham's Fancy with a cinnamon wing will often score where duller flies have failed, the gold body giving the glint that a natural fly in bright sunshine often has.

On the Bringhi and some of the higher streams where bright red and blue winged grass hoppers are about, a fairly big blue winged fly with a red body and a bit of golden pheasant let into the wing is effective. The Durham Ranger also does at times.

Some anglers use our sea trout flies and kill trout with them. The Jock Scott, Silver Doctor, Black Doctor and Alexandra are all at times effective but if one can diagnose the reason for their being so, one is a step nearer clearing oneself of the stigma of being a chuck and chance fisherman, which dry fly men throw at wet anglers generally.

I see I have omitted two of the best of flies, the claret (or brown) and Mallard, and the red spinner. Both are effective when the lower sides of big stones in the stream are to be seen covered with gnats, some of which have a red look about the body, often caused by a parasite.

On the high lakes where red crustacea of the order *Copepoda* are to be seen, I think the Cardinal might be tried and any thing resembling a Daddy long legs would I am sure be appreciated, these flies being very numerous.

F. J. MITCHELL.

SRINAGAR, KASHMIR,
December 1917.

No. XIX.—NOTE ON THE HABITS OF THE DEATH'S-HEAD MOTH, *ACHERONTIA STYX*.

This morning on entering my bathroom I was surprised to find a huge larva of *Acherontia styx* on a wooden stool. I had been watching it for some days with interest feeding and growing on a tomato plant about ten feet outside the door, but had not expected to see it inside the house.

When lifting it out with two toothbrush handles I was surprised to hear it squeak distinctly, not once nor twice merely but every time it was thus handled.

I see that Bainbrigge Fletcher in his "South Indian Insects," page 402 says, "The moth sqeaks when disturbed," but says nothing about the ability of the larva to do likewise. I do not know whether this is a common accomplishment of moth larvæ ?

W. B. BANNERMAN,
Surgeon-General, I.M.S.

MADRAS, *27th November* 1917.

No. XX.—A NEW SPECIES OF *PHYTOPHTHORA* PARASITIC ON THE PARA RUBBER TREE.

Recently a new species of *Phytophthora* has been found parasitic on *Hevea brasiliensis*, the Para rubber tree. It occurs on the leaves, fruits and shoots, causing the leaves to wilt and to fall, the fruits to rot, the branches to die back partially and the tapped surface of the trunk to rot. It has been named after Mr. A. H. Mead who first brought the disease to notice.

Phytophthora Meadii, nov. spec. Mycelio ramoso ex hyphis primo continuis tandem septatis, 3-6μ usque ad 10μ crassis, inter et intracellularibus; sporangiophoris ramosis 10-200μ longis sed aliquanto brevibus ; sporangiis inversipyriformibus sed variis, terminalibus vel lateralibus, in fructibus 33-67 × 14-28μ, in aqua submersis 20-44 × 16-29μ ; zoosporis ovatis vel ellipsoideis, biciliatis, ciliis 16-26μ longis, sporis globosis 7-10μ ; oogoniis pyriformis, hyalinis, levibus vel rugosis, in fructibus 20-48 × 20-40μ in cultibus 22-49 × 20-45μ ; antheridiis persistentibus, hyalinis, rotundis vel ovoideis, levibus 8-16 × 10-16μ, et oogonii basem et oogoniophori partem circumclaudentibus ; oosporis sphæricis, in fructibus 18-28 × 18-26μ in cultibus 16-32 × 15-32μ membrana 2-4μ crassa, mellea aut fulva, levi.

Hab. in foliis, fructibus, ramis cortice *Hevea brasiliensis.*

Travancore, Cochin, Malabar, Indiæ orient.

W. McRAE,
Government Mycologist.

COIMBATORE, *2nd January* 1918.

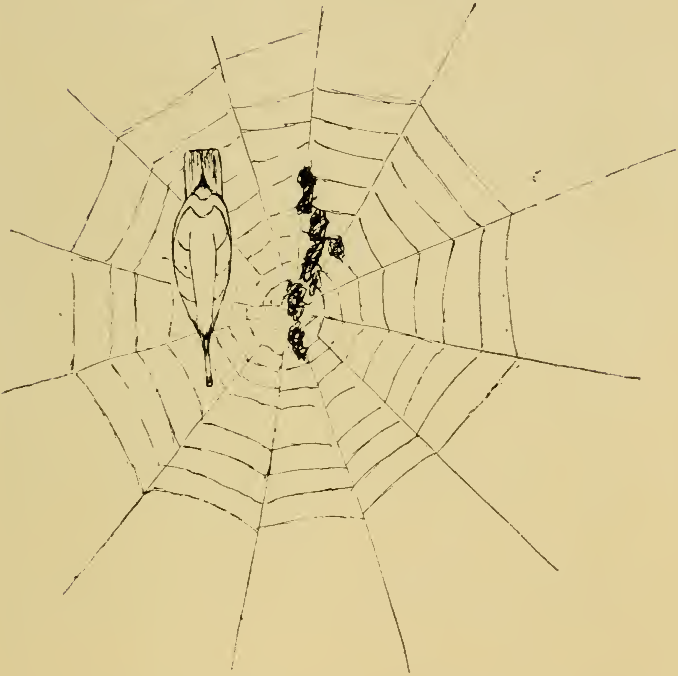
No. XXI.—EXAMPLES OF MIMICRY IN SPIDERS.

(*With an illustration.*)

I am sending in a small phial by registered post two spiders illustrating examples of mimicry.

The one is a small spider imitating a black ant, but the second mimics a piece of dead leaf hanging in the web. The spider is a bright yellow, precisely the shade one often sees in dead leaves, with black markings and the abdomen is attenuated to resemble the stalk. The resemblance, when the spider is at rest, is so close that I was deceived even after handling the creature. I saw the usual debris hanging in a web and alongside what I took to be part of a dead leaf, with the sides partly eaten away or weathered away and the apex dried and broken off. Expecting to find a spider among the debris I poked my finger into them when the "leaf" ran up the web. I then thought from the "leaf" being somewhat convex with the concave side away from me, that the spider was inside the flexed leaf and I could see its legs protruding beyond the leaf ; so I seized what I took to be the stalk to look for the spider and it was only by a close scrutiny that I saw the "leaf" was actually "the spider, the whole spider and nothing but the spider."

(Side views of leaf-like spider.)



LEAF-LIKE SPIDER IN WEB (PORTION) WITH DEBRIS.

All three figures somewhat enlarged. Actual total length in this position about 1″. Colour bright dead leaf yellow with black markings.

I have rarely if ever seen an example of so close and exact a resemblance, certainly never a more deceptive one.

To give some idea of the position of repose taken up in the web, which is not likely to be retained after the tumult of its death in spirits, I have made 3 rough (very rough I fear) sketches. The two first pair of legs are extended forwards and flexed, the others are closely apposed to the sides and are indistinguishable without a lense from the body markings.

In many years of spider collecting and observation I have never seen this species before. I should be much obliged if it can be named. I have no work of reference with me and shall be glad if this note is of any value.

I took this spider in low jungle on a low hill in this district, about 30 miles from the sea and 150 feet above it.

The ant-mimic was on my office table at Gudar in this District.

C. E. C. FISCHER, I.F.S.

NELLORE, 22*nd November* 1917.

No. XXII.—ON RED SEAWATER.

Very few of the numerous people who have travelled up and down the Persian Gulf during the last three years can have failed to notice the numerous patches of sea which look as if they had been sprinkled with particles of red sand, or as if they were composed of a thick tomato soup. These patches often extend over many acres, and a ship may pass through such coloured patches for many miles.

The colour is a rather bright rusty red, and the appearance is due to myriads of unicellular organisms (*Protozoa*), belonging to the Order *DINOFLAGELLATA*, of the Class *FLAGELLATA*. They belong to the genus *NOCTILUCA**; and, like the rest of the Dinoflagellates, they are marked by the presence of a cellulose cuticle with transverse and longitudinal grooves, each containing a whip-like thread or flagellum.

Noctiluca is one of the largest of the Dinoflagellates, and is visible to the naked eye. It varies somewhat in size, averaging about one millimeter (1/25 inch) in diameter. In shape it is globular, but slightly bilobed. It swims freely in the sea by means of great vacuoles within the cell which enable it to float. The protoplasm is situated eccentrically in the cell, and is aggregated into a more or less spherical mass not exceeding about 0·05 millimeter ($\frac{1}{100}$ inch) in diameter. From the periphery of this central compact mass of protoplasm branched processes extend across the vacuoles to the colourless cell wall; the latter is rather thin and very slightly wrinkled, but seems to be tolerably tough.

The longitudinal groove is not well developed, and its flagellum is so minute that it is difficult to make it out. The other flagellum has the form of a thick tentacle arising from a short transverse groove. This tentacle exhibits constant, slow, worm-like movements in the living organism; its length corresponds to about half the diameter of the cell, but is somewhat variable.

The colour of *Noctiluca* is due to that of the central clump of protoplasm; the fine branched processes which extend from it are almost colourless. As already stated the central mass of protoplasm is only about $\frac{1}{100}$ inch in diameter; a fact which enables one to realise the enormous number of organisms which must be present to colour the surface of the sea so deeply over such large areas.

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* By some Naturalists Noctiluca is made the type of a Special Order, *CYSTO-FLAGELLALA.*

Besides the interest which is attached to *Noctiluca* as the cause of the red colouration of the sea, there is another property of this Flagellate which brings it even more prominently before one's notice. As its name suggests, *Noctiluca* is perhaps the commonest organism to which the diffused phosphorescence of the sea at night is due. So many marine animals and plants are luminous that it is impossible to say off-hand to which one of them the phosphorescence on any particular night is mainly due; but, whatever other light-emitting creatures are present, *Noctiluca* usually accompanies them, and it is frequently the predominating form, both in tropical and home seas.

A common method of studying the minute marine floating organisms (Plankton) is to run seawater from a bathroom tap through a very fine-meshed silk net. By this means the solid contents of a considerable quantity of water can be concentrated and examined. The solid particles, animals and plants, are strained off, and collect in a receptacle at the bottom of the net. Unfortunately *Noctiluca* is a very fragile creature, and is so broken up, if subjected to this process, that nothing remains of it, but its empty and shrivelled up cell wall; in which condition it ceases to be phosphorescent and easily escapes notice. It is easy, of course, to procure undamaged specimens of *Noctiluca* by lowering a bucket over the side of the ship at night, but it is difficult to isolate such a small creature. for microscopic examination in such a large quantity of water.

On a recent voyage through the Persian Gulf, I collected a bucketful of 'red water" about midday. With the exception of a very few minute *Entomostraca*, the only organism present was *Noctiluca*, which was in large numbers. It remained alive and active up to 11 p.m. Whenever the bucket was jarred, as by a sudden kick, the upper layer of the water became intensely phosphorescent immediately, and remained so for a second or two. Any concussion seems to cause these Flagellates to become luminous; one sees this very well in the momentary glow which appears in the waves caused by the ship's progress through the water.

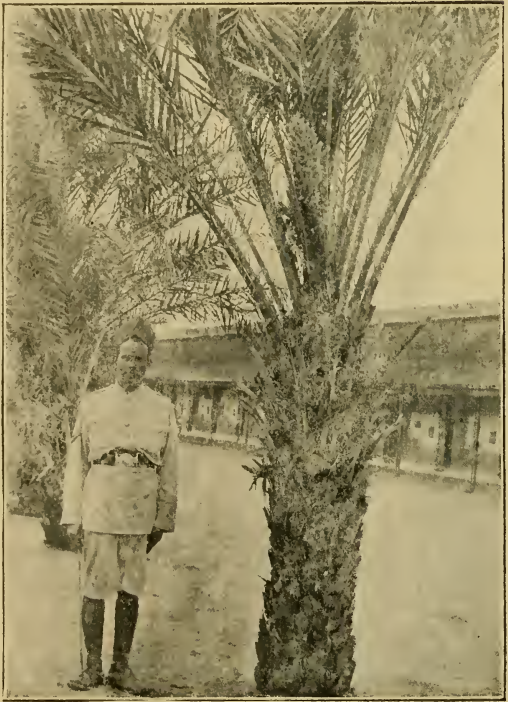
Although *Noctiluca* seems to be the usual cause of red water in the Persian Gulf, a red colouration of the sea is not always due to it. Dr. G. S. West mentions several other Peridinians (Dinoflagellates) which cause a distinct colouration of the sea, by their presence in very large numbers. He says (Cambridge Botanical Handbooks, Algæ, Vol. I.) "In the Indian Ocean, *Ceratium volans* sometimes gives the water a brownish purple colour; in the Japanese Seas, *Gonyaulax polygramma* is frequently the cause of a brown colouration of the water; and in the vicinity of Bombay, *Peridinium sanguineum* has been known to colour the sea red. *Gonyaulax polyedra* causes a red colouration of large areas of the sea off the coast of California during the summer months; it also exhibits a luminosity at night."

Another Alga, one of the Myxophyceæ, *Trichodesmium erythræum*, frequently colours the Red Sea. One of my brother officers tells me that he also collected some "red water" in the Persian Gulf about a year ago; the organism that he found was "rod-shaped"; possibly this was *Trichodesmium*, which, however, I have not observed myself.

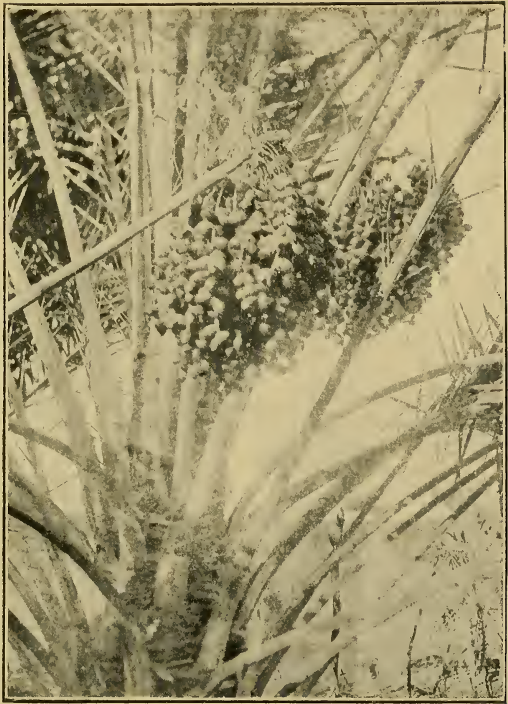
In spite of much good work that has been done for its determination in all these cases, the exact nature of the red pigment, and its disposition in the cell, remain uncertain. The species of *Noctiluca* found in European Seas is *N. miliaris*. That which is so common in the Persian Gulf appears to be indistinguishable morphologically from this form, but I do not know whether it is actually specifically identical.

H. J. WALTON, C.M.Z.S., LIEUT.-COL., I.M.S.

BOMBAY, *February* 1915.



1. Date palm in flower.



2. Two bunches of fruits.

CULTIVATION OF THE EDIBLE DATE PALM (*PHŒNIX DACTYLIFERA*) IN SOUTH INDIA.

No. XXIII.—CULTIVATION OF THE EDIBLE DATE PALM *PHŒNIX DACTYLIFERA* IN SOUTH INDIA.

(WITH A PLATE.)

At the present time when efforts are being made to develop the indigenous resources of India, the following account of the successful cultivation of the date palm in the Central Jail at Trichinopoly may be of interest to members of the Society.

In the article on the date palm by Father E. Blatter, in Vol. XX of our Society's Journal, it is said at page 681, that the tree has been grown in the Deccan, but there is no notice of cultivation in any region to the South of that. It was therefore quite a surprise to me to find a flourishing grove of these palms growing vigorously inside the walls of the Trichy Jail. The following account is from information supplied to me by the late Mr. R. Shubrick, who for many years was the Superintendent of the Central Jail, one of the largest of the prisons in the Madras Presidency. The photographs sent herewith were got from him also, and show the results of his experiment very well indeed.

Mr. Shubrick told me that he got the first idea of date growing from the Boer prisoners camp near Trichy. It seems that the Boers were very fond of dates and were in the habit of spitting the stones out over the verandah. These stones germinated freely, and it appears that the only remains of the prisoners camp is the numerous date trees that have grown from these ejected stones. One is inclined to ask whether the date groves of Sind did not arise from the date stones spat out by the soldiers of Alexander the Great.

In the autumn of 1900 Mr. Shubrick bought a box of "Muscat" dates from the Army and Navy Stores in Bombay, and encouraged by their freshness sowed some of the seeds in a large flower pot. These germinated so freely that the rest were sowed in a seedbed in the jail where they safely passed through the hot weather of 1901. In the rains they were planted out in front of one of the rows of cells which sheltered them from the S. W. winds. They were planted in pits three foot square and ten feet apart. In 1902 another row was planted making, in all, some 70 trees.

Nearly the whole of these trees are still alive and flourishing, and the few that died were replaced by seedlings sown in the pit direct, as it was found by experience that a seed bed was not really necessary. The time of year for sowing appears to be immaterial, as seeds do equally well sown in March or July at Trichinopoly. "All the cultivation that was given to the plants was that the soil round them was kept loose and clean and that during the hot and dry weather, the plants were watered daily. About the third year the young trees change colour and become a greenish grey. As the leaves at the base become dry they need lopping." The trees appear to be hardy.

In February 1907 three trees came into flower of which one was a male. Not knowing at that time that artificial fertilisation was necessary the fruit came to nothing and by May had disappeared In February 1908 seven trees flowered, of which four were males. Mr. Sampson, the Dy. Director of Agriculture, saw them in flower and demonstrated the proper method of performing artificial fertilisation on one of the trees, by tying one of the male spikes among the female ones. A few days later, Colonel Bamber, I.M.S., saw the trees and under his advice another was similarly fertilised. Both these trees produced good fruit which ripened in June. The third unfertilised tree produced imperfect fruit, "inasmuch as all three ovules have survived, while in fertilised trees one ovule survives at the expense of the other two. This fruit is only ripening now, July, and is seedless and poor."

As to cultivation, the cost would be about the same as for a cocoanut tope. Whether watering is really necessary or not Mr. Shubrick does not know but opines that they might do without it. But *vide* instructions for cultivation printed at p. 688, Vol. XX of the Journal.

W. B. BANNERMAN, SURGN.-GENL., I.M.S.

MADRAS, *12th January* 1918.

[The Revd. E. Blatter, S.J., has kindly furnished the following note on the above :—

"Experience has shown that, on an average, the rainfall during the flowering and fruiting period should not exceed 5 inches. This condition is fulfilled in the case of Trichinopoly. Its mean annual rainfall is 37 inches. Up to the latter part of April, but little rain falls. At the end of this month and in May thunderstorms are frequent, and the average rainfall of May is nearly 4 inches. June and July again are dry months, there being on an average only 6 rainy days in the two months. Rain becomes more frequent in August and September, and reaches its maximum in October, in which month there are about 11 rainy days. November and December are also more or less rainy (ex Blanford). As to temperature and humidity, the conditions of Trichinopoly are the best possible. The mean temperature is 82° F., and the mean humidity is 63 per cent., and in April, the driest month, only 54 per cent. Even in June and July it is only 57 per cent., but in November it rises to 76 per cent.

It is interesting to note that the trees mentioned by Surgeon-General Bannerman flowered on February and ripened their fruit in June, *viz.*, a full month (or perhaps even more) before the usual flowering and fruiting season in the well-known date-producing countries. A month later would be fatal to flower and fruit.

There is apparently no reason why the cultivation of the date-palm could not be conducted successfully in many parts of the Deccan and Southern India, provided always that there is a dry period sufficiently long for the reproductive action of the palm. Prof. J. N. Fraser informs me that excellent dates have for a long time been grown at Shorapur (Gulberga Dist. of Hyderabad)."——]

No. XXIV.—FALL OF SEED IN A RAINSTORM.

Under the above heading in Note XX of the Journal of 15th September 1917, Mr. Brook-Fox records a "fall" of grains of a red variety of Jowari during a rain-storm in the Junagadh State, on 12th April 1917. He considers that the grains must have been "*blown in*" from a neighbouring province.

I venture to question the probability of this explanation and to offer another. The dispersal of seeds by wind is, of course, a recognized scientific fact. But the phenomenon is confined either to seeds having a definite wind-dispersal mechanism, or to seeds of extreme lightness. Of the former the achenes of the compositæ with their parachute pappus are the best known instance,—of the latter the seeds of Orchids. To take the latter first it is by reason of their lightness that the seeds of Orchids are able to reach and germinate in the branches of trees. But the distance which such seeds are able to travel is probably slight, and this is borne out by the extremely restricted distribution of the majority of the species. As regards the achenes of compositæ they can certainly travel great distances. Recently experiments have been made to discover the air-movement required to keep various achenes upon the wing (so to speak) : (Proceedings of the Linnaean Society, October 1917, p. 5). Of those tested it was found that the best flier was the achene of *Tussilago farfara L.*, the English "Colt's-foot," which required an air-movement of only ·62 of a mile per hour. The rest varied between that and 7·7 miles per hour. But it is to be remembered that these are all seeds with a pappus at the top specially designed for this very purpose. The carriage over at least 20 miles of sea of certain air-borne spores and seeds was proved by Treub, who found on Krakatoa, 3 years after the eruption, eleven ferns, two species of compositæ, and two grasses, all of which could have been conveyed by wind (Schimper, Plant Geography, Eng. Edn. 1903, p. 80). Unfortunately Schimper does not mention to what species the two grasses belonged. But there are a few grasses whose seeds possess a definite wind dispersal mechanism. None of theabove observation lend any colour to the idea that a comparatively large, smooth seed like that and jowari, artificially developed over ages in order to contain as much farinaceous matter as possible, and therefore heavy even for its size, could be transported any considerable distance by a storm.

Moreover any wind strong enough to raise and hold the grains of jowari would inevitably raise and hold also a quantity of other matter, leaves, straw, paper, &c.

I venture therefore to suggest that this jowari was deposited in the excrement of migratory birds, which at that time (April) would be going north in large numbers. I take it that the grains were not actually seen to fall, in which case it may be assumed that flocks of birds either intentionally, or through pressure of the storm, alighted at the point where the grains were afterwards collected. If the home of the jowari variety could be traced that would give the line of passage of the birds. Seed dispersal by birds is, of course, also a recognized method of plant distribution.

As a means of forecasting the weather this phenomenon is almost certainly useless, like all other special extraneous phenomena; and Mr. Brook-Fox does not suggest otherwise.

L. J. SEDGWICK.

DHARWAR DISTRICT,
29*th January* 1918.

PROCEEDINGS

OF THE MEETING HELD ON 6TH DECEMBER 1917.

A meeting of Members and their friends of the Bombay Natural History Society took place on Thursday, the 6th December 1917, Mr. John Wallace presiding.

The election of the following 22 new members since the last meeting was announced:—Mr. B. H. Bird, I.C.S., Mianwali, Punjab; Mr. T. De Gruyther, Lucknow; Mr. W. St. G. Ashe, Moran P. O., Assam; Lt. C. E. Fellows Manson, Kohat; Capt. W. E. Brierley, I.M.S., F.R.C.S., Bombay; Mr. R. C. Busher, Naini Tal; Mr. Wm. Douglas, Namrup P.O., Upper Assam; Mr. H. Frohlick, Bombay; Major C. F. Scroope, Basra; Mr. Charles Northway, Ceylon; Mr. Oscar Lindgren, Darjeeling; Mr. C. E. Lynch, Assam; The Secretary, Public Library, Allahabad, U.P.; Rev. P. O. Bodding, Dumka, Santal Parganas; Mr. W. J. B. Brooke, Bombay; 2nd Lt. G. H. Porter, Poona; Mr. D. F. Woods, Kurduvadi, Deccan; Mr. A. Steel, Virudupatti, S.I.,; Mr. E. O. King, Madura, S.I.; Mr. A. F. Osborne, Madura, S.I.; Mr. E. Erb, Bombay; and Mr. M. N. Murray, Harda, C.P.

The following contributions to the Museum were received since the last meeting:—

Contribution.	Locality.	Donor.
1 Otter (*Lutra lutra*)	Ludhiana, Punjab	Mr. H. Whistler, F.Z.S., M.B.O.U.
1 Bengal Porcupine (*Hystrix bengalensis.*)	Sylhet, Assam ..	Mr. John Curror.
1 Loris (*Nycticebus* sp.)	(Purchased in Bombay).	Mr. W. S. Millard.
11 Mammals	Dalhousie ..	Capt. N. B. Kinnear.
53 Birds		
2 Boxes of Insects and several botanical specimens.		
1 Pig Skull	Mesopotamia ..	Capt. C. R. Pitman.
59 Birds		
2 Hares		
5 Snakes		
2 Lizards		
2 Fish		
1 Persian Mongoose (*Mungos persicus.*)	Basra	Lt.-Col. F. P. Connor.
1 Great Snipe (*Gallinago major.*)		
2 Snakes and few Insects		
1 Owlet (*Scops giu*)	Off Bunder Abbas.	Corpl. F. L. Hunnikin.
1 Javelin Earth Snake (*Eryx jaculus.*)	Mesopotamia ..	Capt. C. W. Sanders.
10 Insects	Do. ..	Mr. J. M. S. Culbertson.
1 Banded Krait (*Bungarus fasciatus.*)	Upper Assam ..	Mr. W. Douglas.

Contribution.	Locality.	Donor.
1 Cicada .. 1 Booted Eagle (*Hieraëtus pennatus.*) 1 Mantis ..	Hasimara ..	Mr. H. V. O'Donel.
1 Chameleon (alive) (*Chamæleon calcaratus.*)	Ajmere	Mr. W. E. Shipp.
26 Birds' Eggs	Sutlej Valley, Kashmir.	Mr. W. Davies.
6 Birds	Kurla, Bombay Island.	Mr. S. H. Prater.
1 Bat (*Rhinolophus rouxi*) 2 Lizards (*Calotes* sp.) .. 1 Tree Frog (*Rhacophorus malabaricus.*) 2 Dragon Flies .. .. 4 Butterflies .. .	Mt. of Guirim, Bardez, Goa.	Mr. P. F. Gomes.
1 Fat-Tailed Lizard (*Eublepharius macularius.*)	Nowshera, N. W. F. P.	Major H. R. Watson.
1 Black-crowned Finch-Lark (*Pyrrhulauda melanauchen.*)	10 miles of Karachi.	Do.
1 Pigmy Shrew	Basra	Capt. F. C. Fraser, I.M.S.
A collection of Snakes, Birds and Mammals.	Bagdad	Capt. C. M. Ingoldby.
A collection of Bird and Mammal skins.	Baluchistan ..	Capt. J. E. B. Hotson.

Minor contributions from Mr. J. G. Morris, Mrs. M. Neville, Mr. A. E. Jones, Capt. Anderson, and Col. Stevens.

PAPER READ.

The Rev. E. Blatter, S. J. and Prof. F. Hallberg then read a paper entitled "Across the Indian Desert" in which they related their recent experiences in a botanical tour in Rajputana.

PROCEEDINGS OF THE MEETING HELD ON 21ST FEBRUARY 1918.

A meeting of members and their friends took place yesterday, the 21st February 1918, Mr. John Wallace presiding.

The election of the following 32 members since the last meeting was announced:—Mr. E. Lieberherr, Bombay; Capt. P. H. Gosse, R.A.M.C., Poona; Mr. A. Narayanan Nair, B.A., Travancore; Mr. B. H. Duxbury, Bombay; Capt. D. H. Hadden, M.C., R.A.M.C., Poona; Mr. H. R. Rishworth, Bombay; Lt. C. B. Ticehurst, M.A., M.B.O.U., R.A.M.C., Karachi; Mr. W. H. Lewis, Bettiah; Mr. Sarban C. Latif, Calcutta; Capt. G. Laverton, A.D.C., Bombay; Mr. J. A. Duke, Seoni-Chappara; Mr. C. W. Scott Coward, Ahmedabad; Mr. W. J. M. Peebles, Shahibag, Ahmedabad; Mr. J. Stevenson, Ahmedabad; The Mess Secretary, Officers' Mess, 99th Infantry, Ahmedabad; Mr. Wm. McRae, Coimbatore; Capt. A. J. Hawes, R.A.M.C., Poona; Corporal H. Whitehead, R.A.M.C., B.Sc., Mesopotamia; Mr. F. J

Rimington, Bombay; Mr. D. M. Stewart, Ajmer; Mr. L. A. Krishna Iyer, B.A., North Travancore; Mr. Sam Higginbotham, Allahabad; Lt. R. McConnell, R.N., Bombay; Mr. N. M. Billimoria, Bhuj, Cutch; Mr. S. Basil Edwards, Calcutta; Mr. W. H. H. Young, Lahore; Raja Pratap Singh, C.I.E., Ali Rajpur, C.I.; H. H. Rana Ranjit Singh, K.C.S.I., Barwani, C.I.; Mrs. R. C. Edge, P. W. D., Ranchi; Mr. R. H. G. Hastings, Tavoy, L. Burma; Lt. H. Thomson, Poona; and the Librarian, Central India Agency Office, Indore, C.I.

ELECTION OF THE COMMITTEE.

The following gentlemen were elected as office bearers for the present year;—*President*: H. E. the Right Hon. Lord Willingdon, G.C.I.E. *Vice-Presidents*: Mr. J. D. Inverarity, B.A., LL.B., the Hon. Mr. Justice N. C. Macleod and H. H. the Maharao of Cutch, G.C.I.E. *Managing Committee*;—Mr. T. Bainbrigge Fletcher, F.E.S.; Mr. T. R. Bell, I.F.S.; Mr. C. L. Burns; Rev. F. Blatter, S.J.; Mr. E. Comber, F.Z.S.; Lt.-Col. G. H. Evans, C.I.E.; Major M. L. Ferrar; Col. F. C. Fraser, I.M.S.; Prof. G. A. Gammie; Mr. F. Hannyngton, I.C.S.; Mr. C. M. Inglis; Prof. V. N. Hate; Mr. N. B. Kinnear; Major W. G. Liston, C.I.E., I.M.S.; Mr. F. M. Mackwood; Mr. H. P. Macnaghten; Mr. L. H. Savile, A.M.I.C.E.; Mr. R. A. Spence; Lt.-Colonel H. J. Walton, I.M.S., C.M.Z.S.; and Mr. John Wallace.

Honorary Secretary: Mr. W. S. Millard and Honorary Treasurer: Mr. L. Robertson, C.S.I., I.C.S.

Contribution.	Locality.	Donor.
1 Tiger (*Felis tigris*)	Central Provinces.	Mr. A. A. Dunbar Brander.
2 Bengal Porcupines (*Hystrix bengalensis*).	Imphal	Mr. J. C. Higgins, I.C.S.
1 Beatrix Antelope (*Oryx beatrix*).	Western Arabia	Supdt., V. Gardens, Bombay.
3 Persian Gazelles (alive) (*Gazella* sp.)	Basrah	Dy. Civil Commissioner.
4 Jackals (*Canis aureus*) 1 Mongoose (*Mungos persicus*) 1 Tatera (*Tatera* sp.) 8 Birds	Baghdad	Capt. C. M. Ingoldby.
3 Saw-scaled Vipers (*Echis carinata*).	Lahore	Do.
23 Snakes	Jullundhur	Do.
1 Persian Hare (*Lepus craspedotis*). 1 Jackal (*Canis aureus*)	Bushire	Lt.-Col. G. P. Evans.
1 Kalij Pheasant (*Gennæus albocristatus*).	Kumaon	Do.
2 Grizzled Indian Squirrels (*Ratufa* sp.)	Madura, S. I.	Mr. R. F. Stoney.
2 Persian Gazelle masks (*Gazella* sp.) 1 Fox (*Vulpes*) 1 Head and neck and wing of a Grey Lag Goose (*Anser anser*).	Mesopotamia	Capt. C. R. Pitman.

Contribution.	Locality.	Donor.
2 Heads and necks and wing of White-fronted Geese (*Anser albifrons*).	Mesopotamia ..	Capt. C. R. Pitman.
58 Birds		
1 Partridge egg		
1 Squirrel (*Tomeutes* sp.)..	Galaghat, Assam.	Mr. E. L. C. Bishop.
1 Bonelli's Eagle (*Hieraëtus fasciatus*).	Fatehpur, U. P...	Mr. S. G. deC. Ireland, I.C.S.
1 Indian Tawny Eagle (*Aquila vindhiana*.)		
1 Arakan Hill Partridge (*Arboricola intermedi.*) ..	Putao, U. Burma.	Major W. J. Massy.
1 Tufted Duck (*Nyroca fuligula*)		
1 Bittern (*Botaurus stellaris*) ..	Kauna Jheel, 6 miles from Rawalpindi.	Mr. F. J. Mitchell.
1 Shoveller (*Spatula clypeata*) ..	Samara, Mesopotamia.	Capt. R. Hobkirk.
1 Smew (*Mergus albellus*)	Umarkot, Sind ..	Mr. H. D. Baskerville, I.C.S.
1 Comb Duck (*Sarcidiornis melanonotus*).		
1 Painted Snipe (*Rostratula capensis*).	Sind	Mr. C. O. Lowsly.
1 Little Button Quail (*Turnix dussumieri*).		
1 albino Grey Quail (*Coturnix communis*).		
1 albino Jungle Babbler (*Crateropus canorus*).		
2 Common Sandgrouse (*Pterocluris exustus*).	Muscat	Capt. C. W. Sanders.
1 Roller (*Coracias india*)..		
1 Water Scorpion ..		
11 Birds	Naga Hills, Assam.	Mr. J. P. Mills.
30 Snakes	Wynaad	Lt.-Col. F. Wall, C.M.G., I.M.S.
3 Lizards		
9 Frogs		
4 Snakes	Alibag	Mr. A. Alcock, I.C.S.
1 Horse-shoe Viper (*Lachesis strigatus*).	Kundas. 8,000′ ..	Major R. E. Wright, I.M.S.
1 Rose-coloured Starling (*Pastor roseus*).	Byculla. Bombay.	Mr. T. M. Evans.
1 Variegated Kukri Snake (*Oligodon subgriseus*).	Narsinghpur, C.P.	Mr. P. S. Patuck, I.C.S.
Botanical Specimens	Mesopotamia ..	Corporal H. Whitehead.
A collection of mammals, birds, and botanical specimen.	Panjgur-Tarbat ..	Capt. J. E. B. Hotson, I.A.R.O.

Minor contributions from Mr. F. Atlay, Major F. A. H. Clarke, R.A.M.C., Mr. W. S. Millard, Mr. J. E. Needham, Mr. W. S. Rogers and Sir J. S. Donald.

ACCOUNTS FOR 1917.

Mr. L. Robertson, C.S.I., I.C.S., the Honorary Treasurer, presented that account for 1917. Referring to the membership he remarked that the total number of members at the end of 1917 was 1,738 as compared with 1,711 at the end of 1914. It was a matter for congratulation that there had been no decline in the number of members during the years of war. It was, however, very desirable that members should endeavour to persuade others to join as the income from members' subscriptions was the mainstay of the finance of the Society and, indeed, the *Journal* which the members received free was well worth the small annual subscription of Rs. 15.

Turning to the figures in the accounts Mr. Robertson explained that the year opened with a balance of Rs. 5,700 and closed with the balance of Rs. 2,945. Ordinary income and expenditure were about the same as last year. A sum of Rs. 10,000 was invested in War Bonds. The staff had also been assisted to subscribe to the War Loan by advances on easy terms and a sum of Rs. 1,032 had been utilized in this way.

The Mammal Funds Accounts were also dealt with. Owing to the absence of the collectors on active service not much work was being carried on, but several of the members had been good to work for the Society and some interesting collections had been received from Mesopotamia and Baluchistan. The year opened with a balance of Rs. 9,333 and closed with a balance of Rs. 8,962. This will suffice to carry on the work in the present restricted scale, but when collectors again become available an energetic appeal would have to be made for funds.

Mr. Robertson mentioned that the Secretary of State, Mr. Montagu, paid a visit to the Society's Museum in January last and took great interest in the collections and in the work being done by the Mammal Survey.

PAPERS READ.

The following papers were read :—(1) "The Cultivation of the Edible Date Palm in India" by Surgeon-General W. B. Bannerman, C.S.I., I.M.S. :—In which an account was given of the successful cultivation of this palm in Trichinopoly Gaol. Photographs of the trees and fruit were exhibited and it was suggested that the cultivation might prove successful at many places in the Deccan. (2) "On Non-parasitic Plant Diseases" by the Revd. E. Blater, S. J. The papers will be published in full in the Society's *Journal.* The meeting ended with a vote of thanks to the various contributors.

Bombay Natural History Society.

OFFICE-BEARERS, LIFE MEMBERS, AND MEMBERS
ON 1st DECEMBER 1918.

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Bombay Natural History Society.

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Colvin, Miss B.	Bombay.
Comber, Edward (F.Z.S.)	Bombay.
Condon, E. C. H. (M.A.I., A.M.I.C.E.)	Fatehgarh.
Conder, J. M.	Kawkareik.
Congreve, C. R. T.	Coimbatore.

Conley, Andrew	... Jamaica.
Connor, Lt.-Col. F. P. (F.R.C.S., I.M.S.)	... Mesopotamia.
Conservator of Forests, N. C. Division...	... Jubbulpore, C. P.
Cooch Behar, Maharaj Kumar Victor N. Narayan.	Cooch Behar.
Coode, J. M. (*Life Member*)	... Lahore.
Cook, Chas.	... *Europe.*
Cook, J. Pemberton	... Africa.
Cooke, E. Bernard...	... Bina, C. P.
Cooper, Capt. D. G. (I.M.S.)	... Bombay.
Cooper, G. E. R.	... Mussoorie.
Cooper, H. L.	... Jorhat.
Cooper, T.	... *Europe.*
Corbett, G. L. (I.C.S.)	... Saugor, C. P.
Cosens, Capt. F. R....	... *Europe.*
Cosens, Lieut. G. P.	... Sudan.
Cotton, C. W. E. (I.C.S.)	... Madras.
Cotton, W. B. (I.C.S.)	... Wano.
Courthope, E. A.	... Simla.
Coverton, Professor A. L.	... Bombay.
Covernon, S. H. (I.C.S.)	... Thar and Parkar.
Cowie, Rev. A. G. G. (*Life Member*) ...	... Punjab.
Cox, C. E. C. (F.Z.S.)	... Simla.
Cox, Lt.-Genl. Sir P. Z. (F.Z.S., F.R.G.S., K.C.I.E.)	... Teheran.
Craw, H. H. (*Life Member*)	... Rangoon.
Crawford, F. L.	... Raipur.
Crawford, Leslie	... Bombay.
Crawford, W. M. (I.C.S.)	... Purulia.
Crerar, J. (I.C.S., C.I.E.)	... Bombay.
Crompton, Capt. J....	... Bannu.
Cross, R. G.	... Daloo P.O.,Cachar
Crosthwaite, B. M.	... Ywatoung.
Cruickshank, Capt. J. E.	... Dehra Dun.
Cruickshank, W. D. (A.M. I.C.E.) ...	... Bharatpur.
Crum, W. E. (C.B.E.)	... Calcutta.
Cubitt, G. E. S. (I.F.S.)	... Kuala Lumpur.
Cuffe, Lady C. T. W.	... Maymyo.
Culbertson, J. M. S. (A.M.I.C.E.) ...	... Karachi.
Cumming, Capt. E. J.	... Ahmednagar.
Cunningham, Lt.-Col. A. H. (R.E.) ...	... Roorkee.
Curran, Capt. W. J.	... *Europe.*
Currey, E. S.	... *Europe.*
Currie, A. J.	... Bandar Abbas.
Currie, M. M. L. (I.C.S.)	... Delhi.
Currimbhoy Ebrahim, Sir, Bart. ...	... Bombay.
Curror, John	... S. Sylhet.
Curry, J. C.	... Karachi.
Cursetji, Khan Bahadur C. M. (*Life Member*)	... Bombay.

Cutch, H. H. Sir Shri Kengurji Sawai Bahadoor, the Maharao Saheb of (G.C.I.E., G.C.S.I.) (*Life Member*)	Bhuj, Cutch.
Cuvelier, E. D. A.	Nowshera.
D'Abreu, E. A.	Nagpur.
Daly, Col. Sir Hugh (K.C.I.E., C.S.I.)	*Europe.*
Daniel, C. J.	Dharmsala.
Danson, J. W. W.	*Europe.*
Darjeeling, The Vice-President, Natural History Museum	Darjeeling.
Darjeeling Gymkhana Club, The Secretary	Darjeeling.
Dart, G. Wesché	Bombay.
Datia, H. H. the Maharaja Lokendra Govind Singh, Bahadur	Datia, C. I.
Datta, Dr. D. N. P. (M.D.)	Hoshiarpur.
Daukes, Major C. T.	Lansdowne.
Davidson, J.	*Europe.*
Davidson, Major J. (I.M.S., D.S.O.) (*Life Member*)	Dehra Dun.
Davidson, Norman	Raichur.
Davidson, H. M. M.	Behali P.O., Assam.
Davies, H. J. (F.G.S.)	Lucknow.
Davies, W.	Poona.
Davis, G. (I.C.S.)	Sukkur.
Davison, A.	Mandla, C. P.
Dawes, Lt.-Col. C. D. (I.M.S.)	Bombay.
Dawkins, C. G. E. (I.F.S.)	Katha, U. Burma.
Dawson, H.	Chittoor.
Dawson, W. G. (F.E.S.)	*Europe.*
Dawson, W. H. (I.C.S.) (*Life Member*)	*Europe.*
D'Cruz, A. M.	Bombay.
Deakin, Mrs. M. E.	Calcutta.
Deane, N. B.	Calcutta.
De Carteret, St. G.	Orai, U. P.
De Gruyther, T.	Lucknow.
De Rhe-Philipe, G. W. V. (F.E.S.)	Lahore.
De Zwart, W.	Medan, Sumatra.
Delany, M. F.	Bombay.
Delmege, C. H. (R.E.)	Mesopotamia.
Delmé-Radcliffe, Major A.	Bombay.
Delmé-Radcliffe, Lt.-Col. H. (F.Z.S., F.R.G.S.)	*Europe.*
Deputy Director of Agriculture, Burma	Mandalay.
Dew, Lt.-Col. A. B. (C.S.I., C.I.E.)	Quetta.
Dewar, D. (I.C.S.)	Benares.
Dewes, Lt.-Col. F. J. (I.M.S.)	Rangoon.
Dhar, H. H. The Raja of (K.C.S.I.) (*Life Member*)	Dhar, C. I.
Dharamdas Tribhuvandas Varjivandas	Bombay.

Dholpur State, The Maharaj Rana Udaibhan Saheb Bahadur, Dholpur	Rajputana.
Dhrangadhra, H. H. Ghanshyam Sinhji	Kathiawar.
Dhunjibhoy Bomanji (*Life Member*)	Bombay.
Director of Agriculture, Bombay	Poona.
Director of Agriculture, F. M. S.	Kuala Lumpur.
Dixit, D. L. (B.A.)	Poona.
Dobbs, J. G.	Raichur.
Dobbs, W. E. J. (I.C.S.)	Simla.
Dodgson, Major R. C.	*Europe.*
Dods, Capt. E. R. S.	Bombay.
Dods, W. X.	Calcutta.
Donald, C. H.	Dharmsala.
Donaldson, A. E.	Rangoon.
Donaldson, Pte. H.	Bombay.
Donaldson, R.	Bandikui.
Donovan, Lt.-Col. C. (I.M.S.)	Madras.
Doran, H. F.	Abu Road.
Douglas, Col. A. P. (R.A.)	Simla.
Douglas, W. M.	Namrup P. O.
Dow, H. (I.C.S.)	Surat.
Downing, A. K. Weld	Coonoor, Nilgiris.
Dracott, C. H.	Gangtok.
Drake-Brockman, Major D. H.	Lansdowne, Garhwal, U. P.
Drake-Brockman, D. L. (I.C.S.)	Saharanpur, U. P.
Drake-Brockman, Lt.-Col. H. E. (I.M.S., F.Z.S.) (*Life Member*)	Bombay.
Drummond, Capt. J. G. C.	Seistan.
Drummond, J. R. (B.A., F.L.S.)	*Europe.*
Drummond-Hay, H. M.	Ceylon.
Drury, B. W.	Chanda, C. P.
DuBoulay, The Hon'ble Sir J. H. (I.C.S., K.C.I.E.)	Delhi.
Dubash, K. D.	Bombay.
Duckworth, G. P.	Poona.
Duff, A. C. (I.C.S.)	*Europe.*
Duke, A. H.	Siam.
Duke, J. A.	Seoni-Chappara.
Dumayne, Sir F. G.	*Europe.*
Dunbar-Brander, A. A. (I.F.S., O.B.E.)	Khandwa, C. P.
Dunn, C. W. (I.C.S.)	Rangoon.
Dunsterville, Col. K. S. (R.A.)	*Europe.*
Durie, G. A.	Jubbulpore.
Duxbury, B. H.	Bombay.
Duxbury, Major C. D. (*Life Member*)	Ambala.
Dwane, E. H.	Secunderabad.
Dwane, F. C.	Ballarpur.
Dwane, H. M.	Madras.

Dwane, Lt.-Col. J. W.	*Europe.*
Dyson, Lieut.-Col. T. E. (I.M.S.)	Lahore.
Ebden, J. W.	Mesopotamia.
Eccles, P. (I.C.S.)	Bombay.
Economic Botanist to Government, U. P.	Cawnpore.
Ede, F. J. (A.M.I.C.E.)	Silchar, Cachar.
Edge, Mrs. R. C.	Ranchi.
Edwards, F. H.	Maymyo.
Egerton, Sir Brian (K.C.I.E.)	Secunderabad, Deccan.
Elgee, Lt.-Col. J. W. L.	*Europe.*
Elliott, A. (C.I.E.)	*Europe.*
Elliott, J.	Madura.
Elliott, R. E. A. (I.C.S.)	*Europe.*
Ellis, R. H. (I.C.S.)	*Europe.*
Ellis, S. F.	Sholapur.
Elmhirst, L. K.	*Europe.*
Elmore, A. E.	Tharrawaddy.
Elwes, G. F. W.	Nilgiris.
Elwes, H. J. (F.R.S.)	*Europe.*
Emanuel, A. E. L. (I.C.S.)	Surat.
Emblen, H.	Cachar.
English, E. E.	Bombay.
Erb, E.	Bombay.
Erskine, J.	Ceylon.
Evans, Evan	Dibrugarh, Assam.
Evans, Geoffrey (B.A.)	Jubbulpore, C. P.
Evans, Col. G. H. (I.C.V.D., F.L.S., C.I.E.)	Rangoon.
Evans, Lt.-Col. G. P.	Bushire.
Evans, T. M.	Bombay.
Evans, Capt. J. W. D.	Risalpur.
Evans, Lt.-Col. W. H. (R.E.)	*Europe.*
Evans, Wm.	Bombay.
Evershed, John	Kodaikanal.
Ewing Christian College, The Professor, Department of Biology	Allahabad.
Fairbank, Rev. H.	Ahmednagar.
Fairweather, J. C. T.	Khandwa, C. P.
Faith, N. W.	Bombay.
Farr, E. T. C.	Ceylon.
Farrell, R. C. (I.F.S.)	Hyderabad, Dn.
Farrington, Sir H. A., Bart. (I.F.S.)	Nagpur.
Fawcett, E. B.	*Europe.*
Fawcus, L. R. (I.A.R.)	Meerut.
Fayrer, Major F. D. S. (I.M.S.)	Bombay.
Fell, The Hon'ble Mr. G. B. H. (C.I.E., I.C.S.)	Delhi.
Fellowes, Kyrle	Satara.

Fellowes-Manson, Lt. C. E.	Kohat, N.-W. F. P.
Fenton, Col. L. L.	*Europe.*
Fenton, Capt. L. S.	Mesopotamia.
Fernandes, B. A.	Bandra.
Fernandes, J.	Pachmarhi, C. P.
Ferrar, Major M. L. (I.A.)	Bombay.
Field, Frank	Gonda, U. P.
Field, F. M. S.	Mesopotamia.
Field, G. G.	Allahabad, U.P.
Field, W. P.	Jalpaiguri.
Fields-Clarke, V. H. T. (I.F.S.)	Maymyo.
Finlay, Sir C. Kirkman	*Europe.*
Fischer, C. E. C. (I.F.S.)	*Europe.*
Firth, Lt.-Col. R. A.	Nowshera.
Fitz-Gerald, Capt. A.	Bombay.
Fitz-Gibbon, Lt. F. (R.A.)	Africa.
Fitzpatrick, G. V.	Mesopotamia.
Fleming, Lt.-Col. A. M. (I.M.S.)	*Europe.*
Fletcher, A. B.	Mesopotamia.
Fletcher, T. Bainbrigge (F.E.S.)	Pusa.
Fletcher, G. G.	Bombay.
Florence, James	Calcutta.
Flower, Capt. S. S.	*Egypt.*
Flynn, A. A.	Karachi.
Forbes, Alister	Bombay.
Forest Botanist, Forest Research Institute	Dehra Dun.
Forsham, R.	Bombay.
Forster, T. W. (B.F.S.)	Mansi.
Forsyth, Dr. W.	*Europe.*
Foster, O. B.	Ambala.
Foster, R. Guy	Sallebile P. O.
Foster, Major R. T.	*Europe.*
Foulkes, R.	Madura.
Foulkes, Lt.-Col. T. H. (I.M.S.) (*Life Member*)	Aden.
Fountaine, Miss M. E. (F.E.S.)	California.
Fowler, Mrs. C.	Bombay.
Francis, H. F. (R.G.A.)	Rangoon.
Francis, Capt. R. F.	Jullundur.
Fraser, Duncan	*Europe.*
Fraser, D. de M. S.	Shiraz, Persia.
Fraser, Major F. C. (I.M.S., M.D., F.L.E.S.)	Poona.
Fraser, J. S.	Madras.
Fraser, Sir Stuart (I.C.S., C.I.E., K.C.S.I.)	Hyderabad, Dn.
Fraser, S. G. G.	Mesopotamia.
Fraser, W. S.	Ajmer, Rajputana.
Frei, Max	Bombay.
French, H. A. L.	Karachi.
Frenchman, D. P. (B.SC.)	Bombay.

Frere, Capt. A. G.	Cannanore.
Friedlander, F. L.	Calcutta.
Frizeile, Major J.	Campbellpur.
Frohlick, H.	Bombay.
Fry, John T.	Bombay.

Gaikwad, Shrimant Sampatrao	Baroda.
Gairdner, K. G.	Bangkok.
Gale, A. C.	Royapuram.
Gales, Sir R.	Simla.
Gammie, Prof. G. A. (*Life Member*)	Kirkee.
Garbett, C. C. (I.C.S.)	Baghdad.
Gardyne, Major A. D. G.	*Europe.*
Garrett, H. B. G. (I.F.S.)	Bangkok.
Garrett, R. S.	Delhi.
Gatherer, Capt. R. G. T.	Lansdowne.
Gaye, W. C.	*Europe.*
Gebbie, F. St. J.	Bombay.
Gent, J. R. P. (I.F.S.)	Calcutta.
Gervers, Major F. R. S.	Nowshera.
Gharpurey, Major K. G. (I.M.S.)	Muscat.
Giberne, H. D.	*Europe.*
Gibson, E. C. (I.C.S.)	Bharatpur.
Gibson, R. E. (I.C.S.)	Hyderabad, Sind.
Gibson, Dr. W. R. (F.R.C.S., L.R.C.P.)	Madras.
Gilbert, C. C.	*Europe.*
Gilbert, C. E. L. (I.F.S.)	Nasik.
Gilbert, R. N.	Dongri P. O.
Gilbert, T.	Dharwar.
Gilbert-Cooper, W. J. (I.F.S.)	Kado, Moulmein.
Gilchrist, G. W.	Bombay.
Gill, H.	Cachar.
Gillum, Hon'ble Mr. S. J.	Bombay.
Gimlette, Lt.-Col. G. H. D. (C.I.E., I.M.S.)	Bangalore.
Gimson, C. (I.C.S.)	Sylhet.
Girard, George	Calcutta.
Girvin, Lt.-Col. J. (R.A.M.C.)	*Europe.*
Gladstone, H. S. (F.Z.S., F.R.S.E.)	*Europe.*
Glascock, L. C. (M.V.O.)	Lahore.
Glasson, J. W. (I.C.S.)	Madras.
Gleadow, F. (F.R.M.S.)	*Europe.*
Glennie, E. A.	Karachi.
Godfrey, E. J. (B.SC.)	Bangkok.
Godson, Capt. C. A. (I.M.S.)	*Europe.*
Goldsmith, Dr. B. K.	Bombay.
Goldsmith, Capt. H. A.	Mesopotamia.
Gombert, Rev. F., S.J.	Trichinopoly.
Gomme, D. E. (I.A.R.O.)	Calcutta.

Gondal, Kumari Shri Bakuverba	Gondal.
Gonsalves, A. F. (*Life Member*)	Bandra.
Gooding, G. C.	Calcutta.
Gordon, D. M.	Keng Tung, S. Shan States.
Gordon-Canning, C. J.	Bettiah.
Gore, F. W.	Assam.
Gosse, Capt. P. H. (R.A.M.C.)	Poona.
Gough, Lt.-Col. H. (I.A.)	Shiraz, Persia.
Gould, B. J. (I.C.S.)	Seistan.
Graham, A. A.	Mussoorie.
Graham, A. K.	*Europe.*
Graham, C. T.	Rangoon.
Graham, Capt. G. F. (I.M.S.)	Jhelum.
Graham, L. (I.C.S.)	Rajkot.
Graham, R. J. D. (M.A.)	Nagpur, C. P.
Grant, F. A.	Rangoon.
Gravely, F. H.	Calcutta.
Greaves, H. R.	*Europe.*
Green, E. Ernest (F.E.S.)	*Europe.*
Green, E. J. (I.A.R.O.)	Basra.
Green, S. A. C. (I.C.S.)	Shahbandar.
Greer, Major F. A.	Shwebo.
Greer, W. (I.C.S.)	Belgaum.
Gregory, Major C.	Mesopotamia.
Gregson, Capt. C. D.	*Europe.*
Gregson, E. G. (C.I.E., C.M.G.)	Baghdad.
Gregson, T. S.	Bombay.
Grieve, A. N. (I.F.S.)	Purulia
Grigson, P. St. J. B.	Pakokku.
Grönvold, H.	*Europe.*
Grubbe, Major E. A.	*Europe.*
Gruer, H. G. (I.C.S.)	Amraoti Camp.
Gupta, B. Sen	Tezpur.
Gupta, Basant Lal (M. SC.)	Lucknow.
Gwyer, C. (I.F.S.)	*Europe.*
Hacker, K.	*Europe.*
Hadden, Capt. D. H. (M.C., R.A.M.C.)	Bombay.
Haefliger, O.	Lyallpore.
Haffender, E. D. H.	Henzada, Burma.
Haigh, P. B. (I.C.S.)	Satara.
Hall, C. J.	Koni, S. I.
Hallberg, F.	Bombay.
Halliday, Lt.-Col. H. M. (I.A.)	Summerpur.
Hamber, L. G. W.	Dharmsala.
Hamid, A. Ali	Godhra.
Hamilton, A. G.	*Europe.*

Hamilton, J. D. (B.F.S.)	Taungdwingyi, Burma.
Hamilton, W. S. (I.C.S.)	Gujranwala.
Hampson, A.	Bombay.
Hampson, S.	Bombay.
Hankin, A. C. (C.S.I., C.I.E.)	Secunderabad.
Hanhart, S.	Bombay.
Hankin, Dr. E. H.	Agra.
Hannyngton, F. (I.C.S.)	Mercara, Coorg.
Hannyngton, W. O.	Shwebo, Burma.
Harcourt, Major J. S. M.	Dehra Dun.
Hare, Major G. A. (R.A.)	Dum Dum.
Hargreaves, C. K.	Taungoo.
Harker, Mrs. E. M.	Nasik.
Harper, E. W. (F.Z.S.)	Calcutta.
Harris, Lt-Col. O. M. (R.H.A., D.S.O.)	*Europe.*
Harris, W.	Gauhati.
Harrison, A. J.	*Europe.*
Harrison, Major C. F.	Tavoy.
Harrison, Mrs. H. Z.	Jodhpur.
Harrison, J. S.	Secunderabad.
Harrison, R. T. (A.M.I.C.E.)	Karachi.
Harrold, W. P.	Abu Road.
Hart, G. S. (C.I.E.)	Simla.
Harter, R. W.	Bombay.
Hartshorne, J. F. B. (I.C.S.)	Poona.
Harvey-Kelly, Capt. C.	Karachi.
Harvey, Major W. F. (I.M.S.)	Kasauli.
Haslam, R. E.	*Europe.*
Haslehurst, H. M.	Rangoon.
Hassells-Yates, Major G. A. (R.G.A.)	Simla.
Hasted, H. R. G.	Madras.
Hastings, J. R. G.	Tavoy.
Hastings, Mrs. G. F.	Bombay.
Hatchell, D. G.	*Europe.*
Hate, Prof. Vinayek N.	Bombay.
Haughton, Major H. L.	Bombay.
Hawes, Capt. A. J. (R.A.M.C.)	Poona.
Hawes, C. G.	Bombay.
Hawkins, T. B.	Bombay.
Hawley, Capt. W. G. B.	Quetta.
Hay, Dr. A.	Bangalore.
Hay, E. Alan	*Europe.*
Hay, E. F. A.	Pyinmana.
Hayden, H. H. (C.I.E.)	Calcutta.
Hayes, B. H.	Meiktila.
Hayne, A. R. S.	Mesopotamia.
Headlam, Comdr. E. James (R.I.M.)	Mombasa.

Hearn, Capt. E. S.	Bombay.
Hearsey, T. N. (I.F.S.)	Vellore.
Heath, R. H. (C.E.)	*Europe.*
Hector, G. P. (M.A., B.SC.)	Dacca.
Henderson, Capt. H. D.	East Africa.
Henderson, W. L.	Rangoon.
Herbert, E. G.	*Europe.*
Herbert, Capt. V. A.	*Europe.*
Heron, F. A.	Punjab.
Hervey, A. C. C.	Peshawar.
Hervey, C. O. D.	Trichinopoly.
Hewson, R. B.	Jalna.
Heyder, H. M.	Ambala.
Hezlett, J.	Assam.
Hichens, G. W.	Rangoon.
Hickey, B. S.	Champarun.
Hickman, R. St. J.	Cachar.
Hicks, E.	Assam.
Hide, P. (*Life Member*)	Indore.
Higginbotham, Sam	Allahabad.
Higgins, J. C. (I.C.S.)	Imphal, Manipur.
Higginson, G. R.	Fatehgarh.
Hignell, S. R. (I.C.S., C.I.E.)	Purulia.
Hiley, A. C. (I.F.S.)	Belgaum.
Hill, Hon'ble Sir Claude H. (I.C.S., C.I.E., K.C.S.I.)	Delhi.
Hill, Major R. D. O. (*Life Member*)	Dehra Dun.
Hingston, Capt. R. W. (I.M.S.)	Mesopotamia.
Hirst, Dr. L. F.	Colombo.
Histed, S. E.	Karachi.
Hitchcock, R. H.	Calicut.
Hitchcock, R. V.	Shahabad.
Hobart, R. C. (I.C.S.)	Roorkee.
Hobkirk, Capt. R.	Basra.
Hodgins, R. D. Scoble	Travancore.
Hodgkins, C. J.	*Europe.*
Hodgson, H. P.	*Europe.*
Hogan, J. G.	Indore.
Hojel, Lt.-Col. J. G. (C.I.E., I.M.S.)	Bombay.
Hole, R. S. (I.F.S.)	Dehra Dun.
Holkar, H. H. the Maharaja Tukuji Rao (*Life Member*)	Indore, C. I.
Holland, L. B. (I.F.S.)	Lahore.
Holme, A. T. (I.C.S.)	Oodeypore.
Holmer, Miss M. R. M. (M.A.)	Delhi.
Holmes, H. R.	Kamptee, C. P.
Holmes, J. F.	Bilaspur.
Hood, A. F.	*Europe.*

Homfray, Jeston (I.F.S.)	Calcutta.
Hoosein Belgrami, The Hon'ble Mr. Syed Nawab Imud-ul-Mulk Bahadoor (C.S.I.)	Hyderabad, Deccan.
Hope, A. J. R.	Simla.
Hopkins, G. H. E.	Bombay.
Hopwood, J. C.	Rangoon.
Hopwood, S. F. (I.F.S.)	*Europe.*
Horsfall, G. L.	*Europe.*
Hoseason, W. S.	Bombay.
Hosken, A. Fayrer	*Europe.*
Hotson, Lt.-Col. J. E. B. (O.B.E., I.A.R.O.)	Shiraz, Persia.
Howell, E. B.	Shanghai.
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BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT of ACCOUNTS from 1st January to 31st December 1917.

RECEIPTS.	Rs. a. p.	Rs. a. p.
To BALANCE OF 1ST JANUARY 1917—		
Cash with the National Bank of India, Ld...	618 14 7	
Fixed Deposit with the Mercantile Bank, Ld.	5,000 0 0	
Balance as per Postage Book	32 14 6	
" " Petty Cash Book	49 15 11	5,701 13 0
To Subscription for 1914 (in arrears)	90 0 0	
" " " 1915 "	360 0 0	
" " " 1916 "	793 14 2	
" " " the current year	19,414 13 0	
" " , 1918 (in advance)	549 9 6	
" " " 1919 "	15 0 0	
" Life Membership	200 0 0	
	21,423 4 8	
Less—Refund of Subscription ..	105 15 0	21,317 5 8
To Entrance Fees	960 0 0	
" Sales of Journal	1,439 7 7	
" " " Snake Books	1,139 2 0	
" " " Catalogue of Library	4 0 0	
" " " Pigeon Books	207 11 4	
" " " Mr. Chibber's Paper..	375 0 0	
" " " Authors Copies	25 10 6	
" " " Mesopotamia Notes	18 0 0	
Carried over ..	4,168 15 5	27,019 2 8

PAYMENTS.	Rs. a. p.	Rs. a. p.
By Journal Account	9,090 8 10	
" Salaries..	7,820 15 1	
" General Charges	798 14 8	
" Rent	2,610 0 0	
" Printing and Stationery (including Snake Book)	1,807 6 6	
" Amount paid to Col. Wall being ½ profit on copies of Snake Books sold	1,353 3 6	
" Petty Cash Expenses..	424 2 9	
" Postage Expenses	361 5 2	
" Library Account	146 2 9	
" Furniture "	15 12 0	
" Expenses on Account of General Keary's specimens	13 8 0	
" Sundries	53 5 0	
" Auditors' Fee	130 0 0	
" Amount advanced to Mammal Fund	400 0 0	
" Advanced for Cartridges for Capt. Buxton..	190 0 0	
" Income Tax	129 0 7	
" Insurance paid on Microscope	56 4 0	
" Insurance Premium..	140 10 0	
" Bank Charges	65 4 0	
" Investment in 5½% Indian War Loan	10,000 0 0	35,136 6 10
" Advance to Staff for War Loan	1,031 12 0	
Less—recovered	149 10 4	882 1 8
Balance—		
Cash in hand	47 12 9	
Balance as per Postage ..	54 5 6	
" " Petty Cash	25 13 2	
" with National Bank	2,817 3 9	2,945 3 2
Carried over ..		Rs. 88,963 11 8

STATEMENT of ACCOUNTS from 1st January to 31st December 1917—contd.

RECEIPTS.	Rs. a. p.	Rs. a. p.	PAYMENTS.	Rs. a. p.	Rs. a. p.
Brought forward ..	4,168 15 5	27,019 2 8	Brought forward ..	......	38,963 11
To Grant-in-aid from the Bombay Government.	5,000 0 0				
,, Registration fees on Journals..	103 14 0				
,, Sundries	289 4 9				
,, Interest on Investments..	1,885 12 7				
,, ,, ,, Fixed Deposits	125 0 0				
,, ,, ,, Current Account	205 14 0				
,, ,, ,, Staff's War Bonds	10 0 6				
Refund of expenses	155 11 9				
		11,944 9 0			
Total ..		Rs.38,963 11 8			Rs. 38,963 11 8
			Securities with the National Bank of India, Ld.—		
			3½ % Government of India Pro. Notes ..	8,800 0 0	
			4 % Government of India Conversion Loan.	10,000 0 0	
			4 % Bombay Port Trust Unguaranteed Bonds	14,000 0 0	
			4 % City of Bombay Improvement Trust Bonds	15,000 0 0	
			5½% War Bonds, 1920 Pro. Notes	10,000 0 0	
				57,800 0 0	
			5½% Staff's War Bonds, 1920 Pro. Notes ..	900 0 0	
			Total ..	Rs. 58,700 0 0	

We have seen a letter from the National Bank of India, Limited, to the effect that the above Securities were held on the Society's behalf on 31st December 1017.

Examined and found correct.

(Sd.) L. H. SAVILE,
Honorary Treasurer.

(Sd.) A F. FERGUSON & Co.,
Chartered Accountants, Auditors.

BOMBAY, 21*st February* 1918.

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
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MASS.

NEW GENERIC TERMS.

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